User Guide and Reference Manual

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Chapter 1 Introduction

This chapter is intended to introduce the *Understand 2.0* software.

This manual assumes a moderate understanding of the programming language in which your project is written.

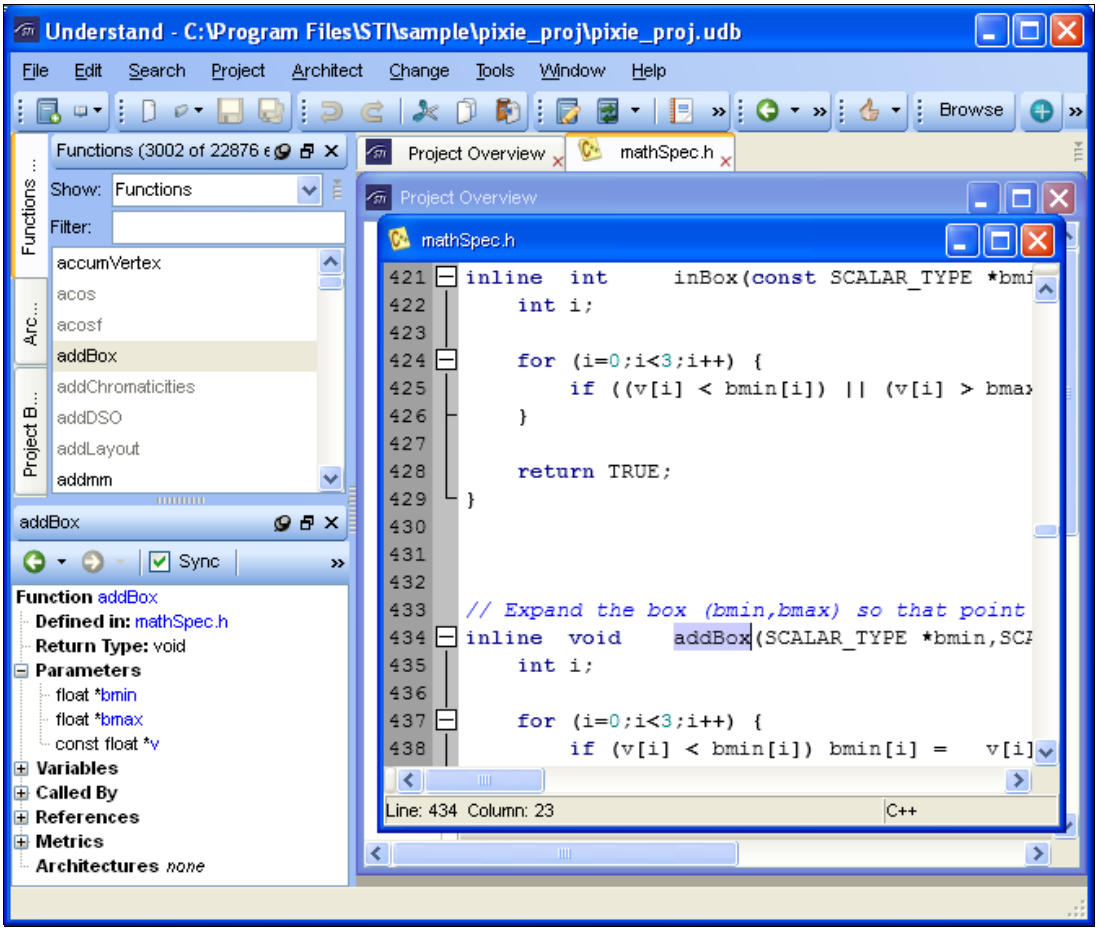
This chapter contains the following sections:

Section	Page
What is Understand 2.0?	1–2
For Those Who Don't Like to Read Manuals	1–4

What is Understand 2.0?

Understand 2.0 is a cross-platform, multi-language, maintenance-oriented IDE (interactive development environment). It is designed to help maintain and understand large amounts of legacy or newly-created source code. The source code analyzed may include Ada, C++, C#, FORTRAN, Java, JOVIAL, and/or Delphi/Pascal.

It offers code navigation using a detailed cross-reference, a syntax-colorizing “smart” editor, and a variety of graphical reverse engineering views.



Understand 2.0 creates a repository of the relations and structures contained within the software project. The repository is then used to learn about the source code.

Understand 2.0 has analysis features that help you quickly answer questions such as:

- What is this entity?
- Where is it changed?
- Where is it referenced?
- Who depends on it?
- What does it depend on?

Understand 2.0 has architecture features that help you create hierarchical aggregations of source code units. You can name these units and manipulate them in various ways to create interesting hierarchies for analysis.

Programming Language Versions Supported

Understand 2.0 supports Ada, C/C++/C#, FORTRAN, Java, Jovial, and Pascal.

Understand 2.0 supports Ada83 and Ada95 code, separately, or in combination.

Understand 2.0 analyzes K&R or ANSI C source code and most constructs of the C++ language. *Understand 2.0* works with any C compiler, and has been tested with most of the popular ones.

Note: C++ templates are not yet supported.

Understand 2.0 supports C#.

Understand 2.0 supports FORTRAN 77, FORTRAN 90, and FORTRAN 95, in both free and fixed format. Extensions supported include Harris FORTRAN and DEC FORTRAN. We often expand *Understand 2.0* to support common compiler extensions. If you find that the compiler extensions you are using are not currently supported, contact us at support@scitools.com.

Understand 2.0 supports JDK 1.3, 1.4, and most of 1.5. Specifically, the generics introduced in 1.5 are not currently supported. Source code containing generics may be analyzed but generics information will be ignored.

Understand 2.0 supports all versions of Borland's Delphi language and Borland's Turbo Pascal language. It also supports ISO 7185: 1990 (also known as Unextended Pascal) with DEC Pascal extensions. You can also enable support for Ingres embedded SQL statements.

This manual does not provide detailed descriptions of how specific language features are handled.

Use Server Mode to Integrate with Your IDE

Understand 2.0 is designed to be used both for standalone browsing/discovery as well as browsing that is controlled from another application.

You can control *Understand 2.0* from any editor or program from which you can launch “understand.exe”. The client accepts action commands for an entity name, and optional file, line, column specifiers, and more.

For Those Who Don’t Like to Read Manuals

If you are like many engineers at Scientific Toolworks, you like to just dig in and get going with software. We encourage that, or at least we are pragmatic enough to know you will do it anyway! So feel free to use this manual as a safety net, or to find the less obvious features. However, before you depart the manual, skim the next chapter for tips on effectively utilizing what *Understand 2.0* has to offer.

Help is available by choosing **Help->Help** and **Help->FAQ**.

Chapter 2 Parts and Terminology

This chapter is intended to help you put *Understand 2.0* to good use quickly and easily. The chapter describes the basic windows in *Understand 2.0*.

This chapter contains the following sections:

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Understand 2.0 Terminology	2–3
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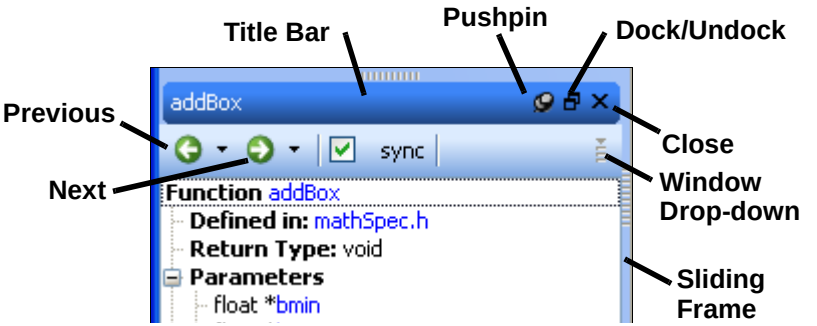
Using Understand 2.0 Windows

Understand 2.0 has a main window and many smaller areas that open within the *Understand 2.0* application window. You can arrange these areas in your workspace to meet your needs.



- **Title Bar:** You can drag the title bar of an area around the main window. If you move to the edge of the main window, a docking area expands. If you drop the area there, it “docks” to the edge of the main window.
- **Pushpins and Drawers:** Click the icon to move an area to a tab along the same edge of the main window to which this area was docked. This is a “drawer” that opens automatically if you point your mouse at the tab title. The drawer closes if you move your mouse away from the area without clicking on it or if you click the title tab of the currently open drawer.

  Click the icon to “pin” a drawer open. Pinned drawers have a title bar and title bar icons like the ones shown above.
- **Dock/Undock:** Click the icon to change the area to an undocked window. Click the icon again in an undocked window to return to a docked area.
- **Close:** Click the “X” icon to close the area or undocked window.
- **Window Drop-down:** Click this small icon to see the right-click menu for this area in general. Right-clicking an item within an area usually displays a right-click menu specific to that item.
- **Sliding Frame:** You can drag the frames between window areas to change their sizes.
- **Previous and Next:** Each area type has different icons below the title bar. For the Info Browser area shown, you can browse through the history of entities viewed. For other areas, you will see other icons.

Understand 2.0 Terminology

Before continuing with the rest of this manual, please take a moment to familiarize yourself with *Understand 2.0*'s terminology. Doing so will make reading the manual more helpful and also put you on the same sheet of music as the technical support team should you need to email or call.

Architect: Architect is a tool and infrastructure that lets humans easily name regions of software. This tool can then generate reports and graphs, and other tools can use architectures when selecting source code sets.

Architecture: An architecture is a hierarchical aggregation of source code units (entities). An architecture can be user created or automatically generated. Architectures need not be complete (i.e an architecture's flattened expansion need not reference every source entity in the database), nor unique (i.e. an architecture's flattened expansion need not maintain the set property).

Architecture Files: Architecture files are external (serialized) architecture files that can be imported into the database each time the database is reparsed. An optional process and list of arguments can be provided to regenerate the file before importing.

Architecture Template: An architecture template is an architecture that may not contain entities. It is a hierarchy from which new architectures can be derived.

Database: The database is where the results of the source code parsing, as well as project settings, are stored. By default this is a project's ".udb" file.

Entity: An *Understand 2.0* "entity" is anything it has information about. In practice this means anything declared or used in your source code and the files that contain the project. Subroutines, variables, and source files are all examples of entities.

Project: The set of source code you have analyzed and the settings and parameters chosen. A "project file" contains the list of source files and the project settings.

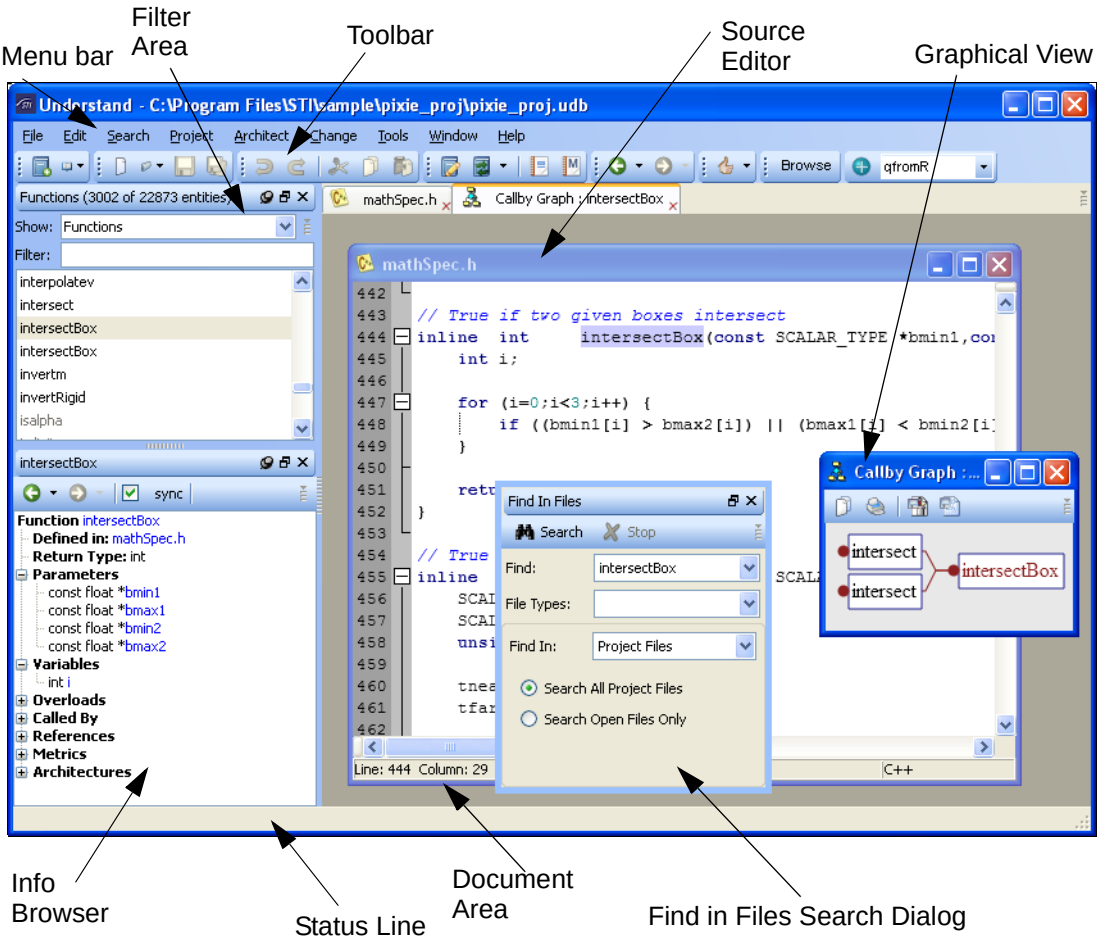
Relationship: A particular way that entities relate to one another. The names of relationships come from the syntax and semantics of a programming language. For instance, subroutine entities can have "Call" relationships and "CalledBy" relationships.

Script: Generally a PERL script. These can be run from within *Understand 2.0*'s GUI, or externally via the "uperl" command. The *Understand* PERL API provides easy and direct access to all information stored in an Understand database.

Snapshot: A snapshot is used to capture the state of the database at a given point in time. Snapshots are used to compare changes between different states of the database.

Parts

The following figure shows the main parts of the *Understand 2.0* graphical user interface (GUI):

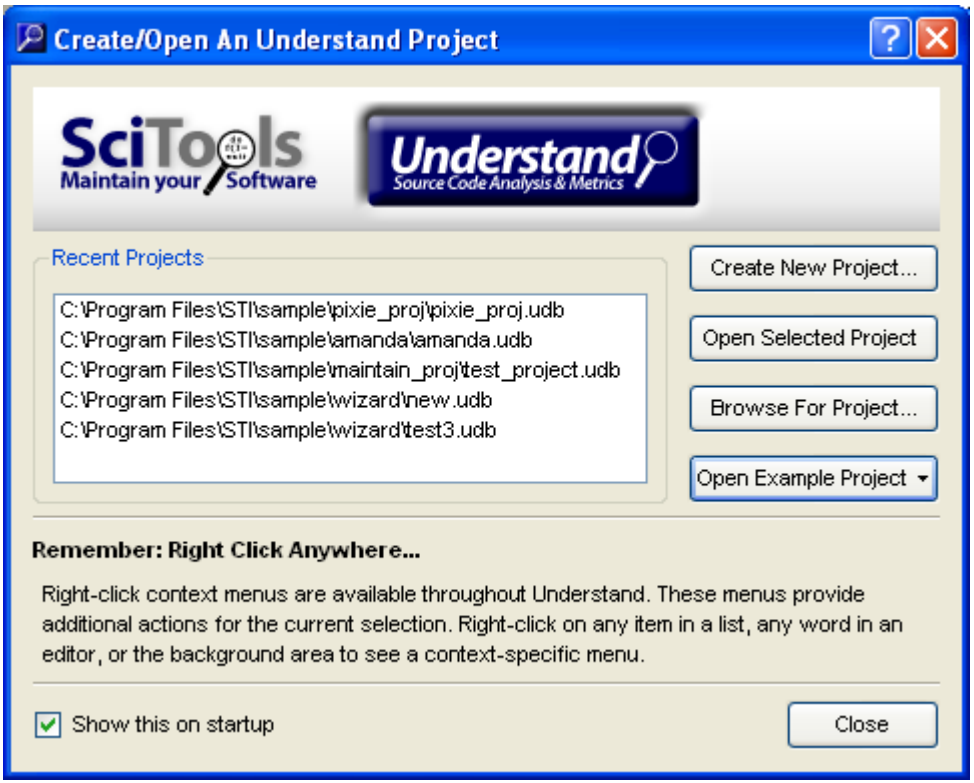


Starting Understand 2.0

When you install *Understand 2.0* on Windows, commands to launch the software are added to your Windows **Start** menu in the SciTools folder.

When you start *Understand 2.0*, you see the Create/Open Project dialog. To begin creating a new project, click **Create New Project**. See *Creating a New Project* on page 3–3 for details.

If you've used a project recently, it is listed in this dialog, and you can select it and click **Open Selected Project**. If the existing project you want to open isn't listed, click **Browse for Project** and browse.


Create/Open An Understand Project
SciTools
Maintain your Software
Understand
Source Code Analysis & Metrics
Recent Projects
C:\Program Files\STI\sample\pixie_proj\pixie_proj.udb
C:\Program Files\STI\sample\amanda\amanda.udb
C:\Program Files\STI\sample\maintain_proj\test_project.udb
C:\Program Files\STI\sample\wizard\new.udb
C:\Program Files\STI\sample\wizard\test3.udb
Create New Project...
Open Selected Project
Browse For Project...
Open Example Project
Remember: Right Click Anywhere...
Right-click context menus are available throughout Understand. These menus provide additional actions for the current selection. Right-click on any item in a list, any word in an editor, or the background area to see a context-specific menu.
Show this on startup
Close

If you want to learn about *Understand 2.0*, click **Open Example Project** and choose an example project that uses a source code language used in your own projects.

Other Ways to Run *Understand 2.0*

For information on running *Understand 2.0* from the command line, see Chapter 12, Command Line Processing.

If multiple users will run *Understand 2.0* from the same Windows machine, each user may have a separate initialization file. These files store user preferences. *Understand 2.0* looks for the initialization file location in the following sequence:

1. %APPDATA% (local settings and applications)
2. %WINDIR% (typically c:\Windows)
3. %STI_INIDIR%

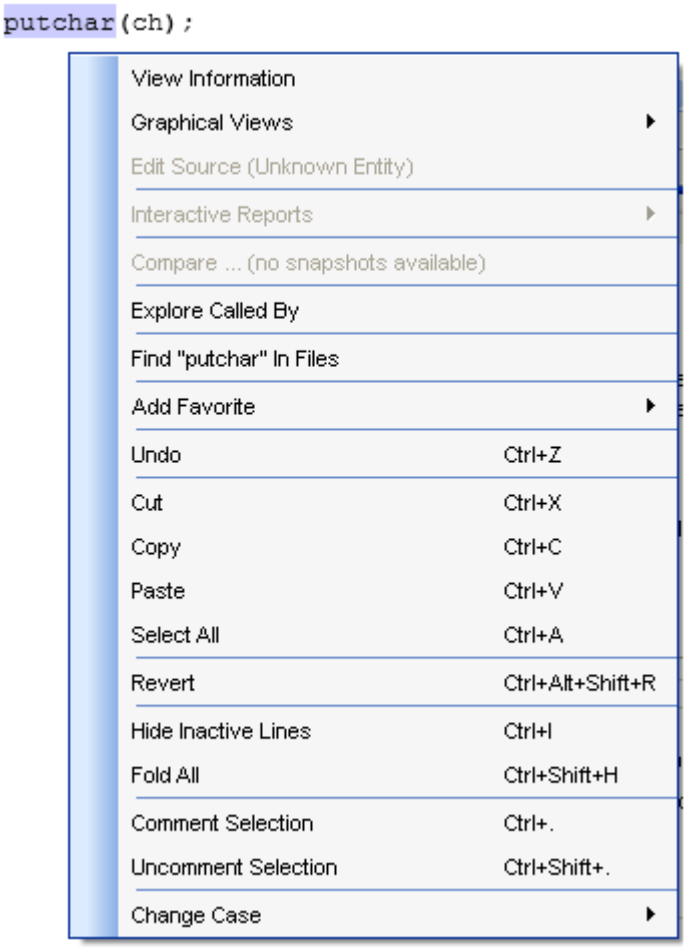
Right-Click Menus Are Everywhere

Right-clicking gets you a long way in *Understand 2.0*; almost everywhere you point you can learn more and do more by bringing up menus with your right mouse button.

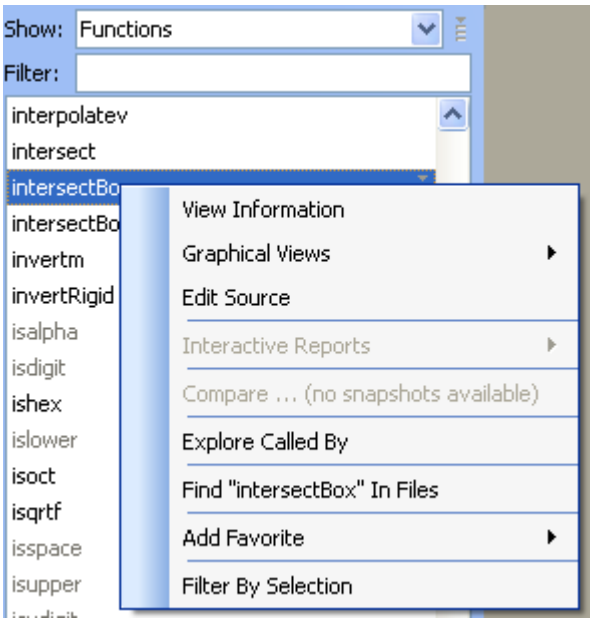
Tip: Hold down the Ctrl key while right-clicking to create new windows rather than re-using existing ones.

Remember to right-click, anytime, anywhere, on any entity to get more information about that entity.

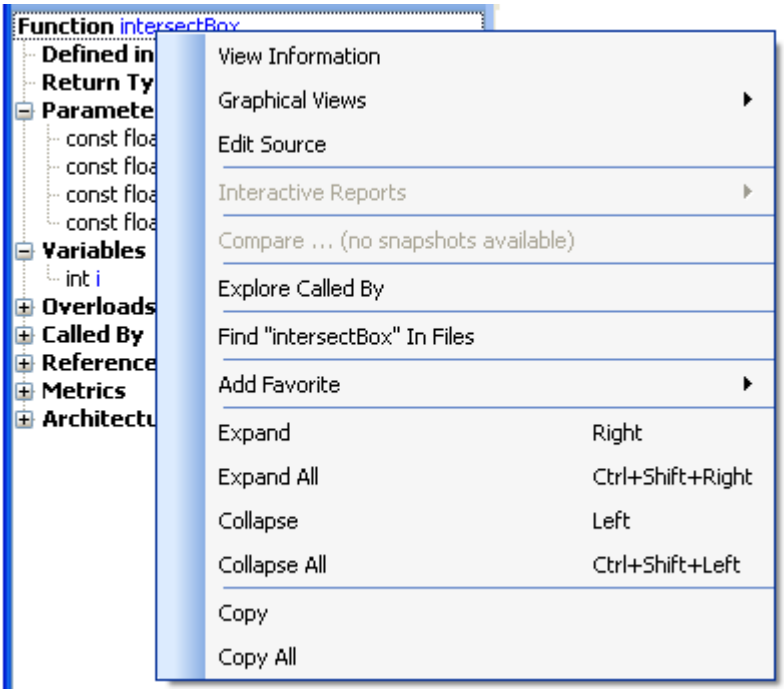
Example: Right-click on an entity in the Source Editor:



Example: Right-click on an entity in the filter area:



Example: Right-click on an entity in the Info Browser:



Quickly Find Things in Your Source

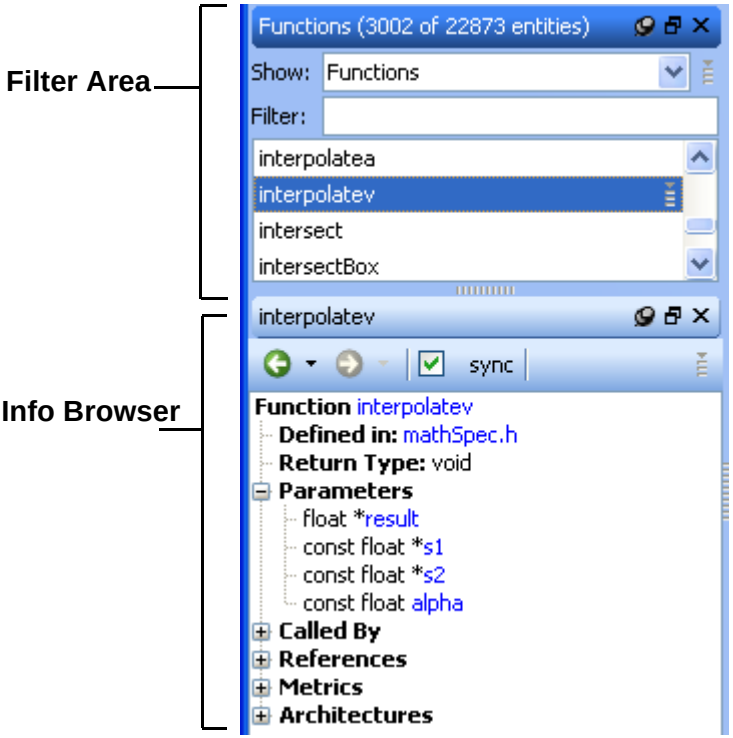
Understand 2.0 provides several ways to quickly locate items of interest in your source code. The windows used include the Filter Area, the Entity Locator, and the Find in Files dialog.

Entity Filter

The filter area of the *Understand 2.0* window helps you quickly find things in your code by separating that database into lists of Files, Classes, Functions, Objects, Types, Macros, Subprograms, Packages, Modules, Blocks, Methods, Interfaces, SQL Tables, and more. The types of filters available depend on the languages you have configured your *Understand 2.0* project to understand.

After clicking in the filter area, you can type a letter to move to the first entity beginning with that letter in the current list.

By default the *Info Browser* shows all known information about the selected entity and is a key to navigating in *Understand 2.0*.



For details, see *Entity Filter* on page 4–5 and *Info Browser* on page 4–8.

Entity Locator

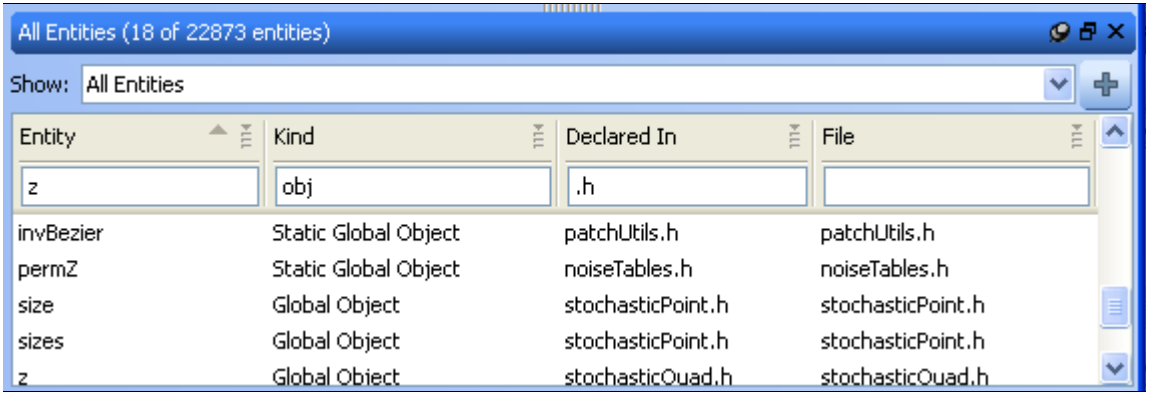
The filter provides a quick way to find major items that were declared and used in your project. However, some items such as local parameters, variables, and unresolved variables (used but not declared in the processed source) are not listed in the filters. To search or browse the entire database for your project, use the *Entity Locator.*

To open the *Entity Locator*, choose **Search->Entity Locator**.

By default, this area lists all the entities in the project. You can search for entities matching a particular text or regex string using the fields above each column.

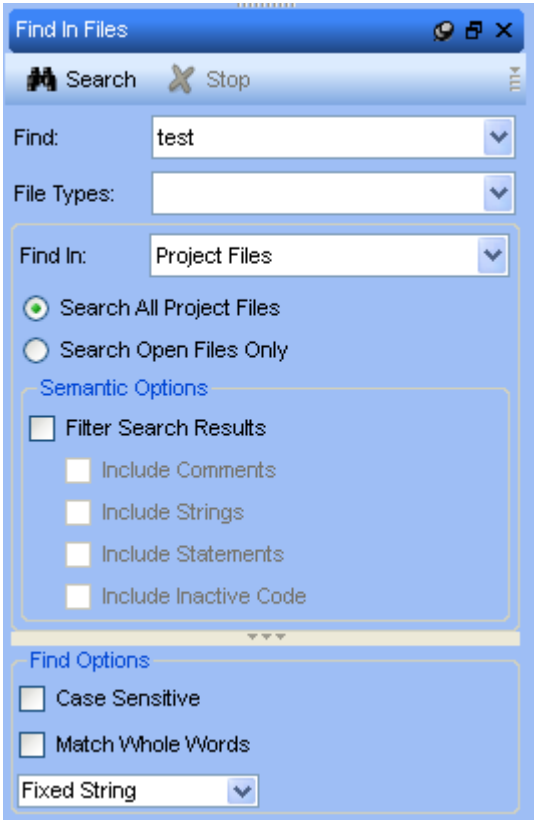
For details, see *Entity Locator* on page 5–3.

As in any other window, the right-click menu is also active:



Find in Files

Similar to the UNIX command *grep*, you may search files for the occurrence of a string. Select **Find in Files** either from the **Search** menu or from a right-click menu.



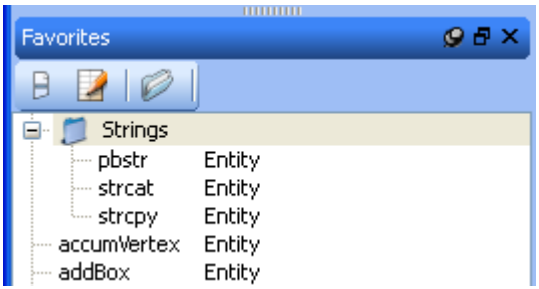
When you click the **Search** icon, a list of all occurrences matching the specified string or regular expression is displayed in the *Find Results* window. Double click on any result to display the *Source View* where the string occurs.

The **Find Options** let you set options such as case-sensitivity and wildcard pattern matching.

See *Find in Files* on page 5–8 for more information.

Favorites

You can place entities and code locations that you often use on your Favorites list. To add a favorite, right-click on it and select **Add Favorite**. To see the Favorites list, choose **Search->Favorites**. Then, double-click a favorite from the list to go to its location.



See *Favorites* on page 4–17 for more information.

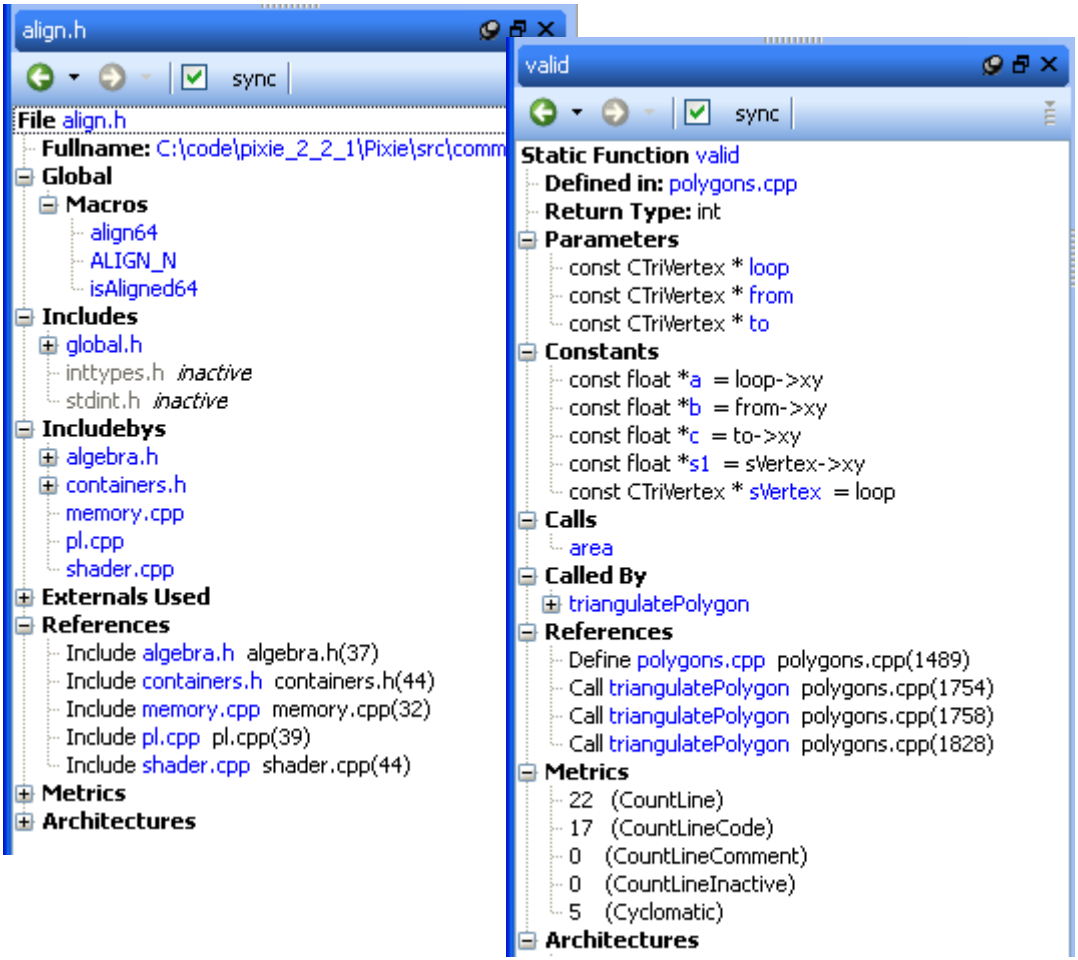
Info Browser

Just about everything *Understand 2.0* knows about code is shown in the Info Browser (IB). The IB is used for all types of entities.

The Info Browser shows different things depending on the type of entity selected.

It shows different kinds of information about entities such as source files, classes, members, functions, types, methods, packages, interfaces, and more. Information that is hierarchical in nature (such as a call relationship) can be expanded multiple levels.

Below are Info Browser windows for a file and a C function:



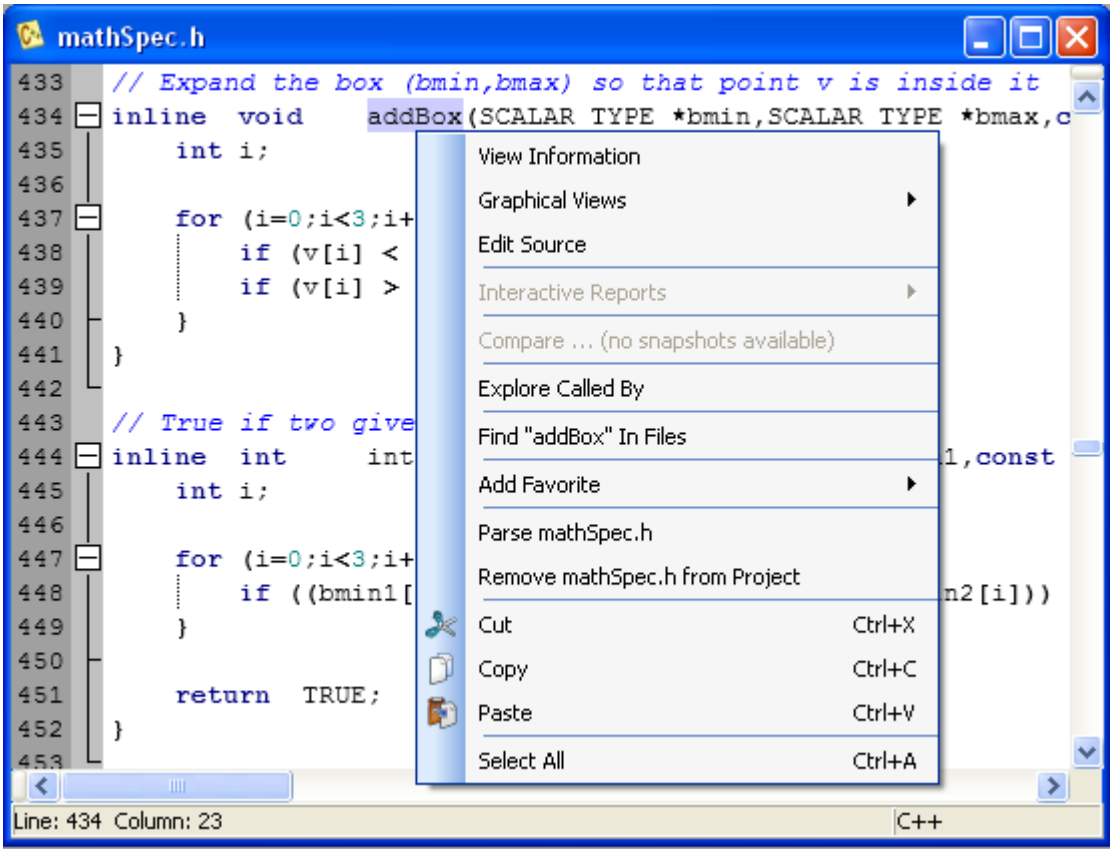
For details, see *Info Browser* on page 4–8.

Source Editor

Understand 2.0 has a source editor that not only lets you edit your source code, it colorizes the source code and also tells you about the code you are editing.

Source can be visited by double-clicking almost anywhere else in the tool. You can move forward or backward through such “visits” by using the **Next** and **Previous** icons in the toolbar.

As with any other place in *Understand 2.0*, a right-click menu is available throughout the editor. To learn about something just right-click on it to see what information is available.

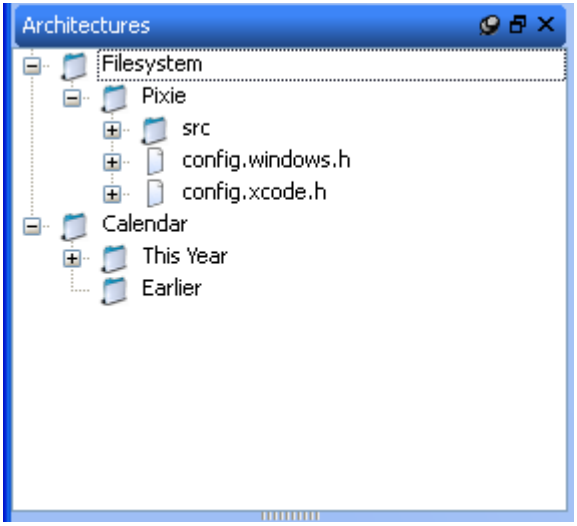


For details, see *Source Editor* on page 6–2.

Architecture Browser

The Architecture Browser allows you to manage *architectures*. It shows a list of all the defined architectures in the database and provides a way to navigate individual architectures.

For example, this windows shows the auto-architectures provided with *Understand 2.0*: Filesystem and Calendar (disabled by default). The Filesystem architecture is expanded somewhat to show the top-level filesystem for an example application.

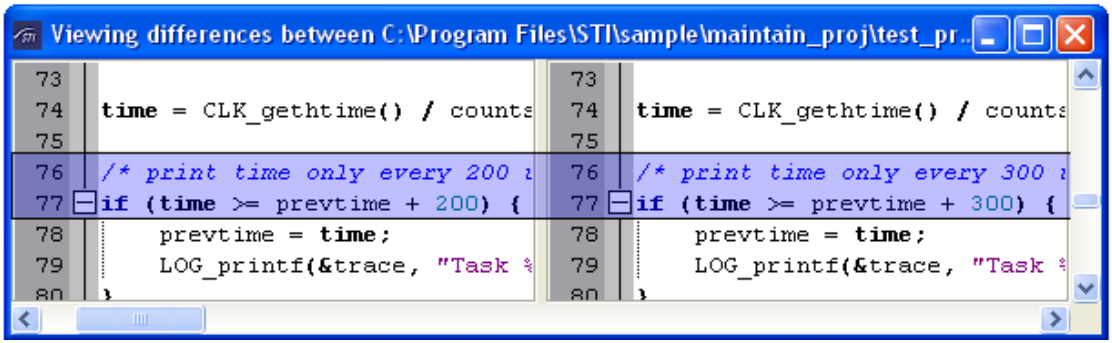


You can use the auto-architectures, create your own architectures, import and export architectures (as XML files), generate graphs and metrics for any level in an architecture hierarchy, and combine architectures through filtering.

For details, see *About Architectures* on page 7–2.

Snapshots Windows

The Snapshots windows allow you to compare versions of files. You can take a snapshot to capture the state of the database at a given point in time. Later, you can compare a snapshot to the current files to find what changes have occurred.


Viewing differences between C:\Program Files\STI\sample\maintain_proj\test_pr...
73
74 time = CLK_gethtime() / counts
75
76 /* print time only every 200 t
77 if (time >= prevtime + 200) {
78 prevtime = time;
79 LOG_printf(&trace, "Task %
80 }
73
74 time = CLK_gethtime() / counts
75
76 /* print time only every 300 t
77 if (time >= prevtime + 300) {
78 prevtime = time;
79 LOG_printf(&trace, "Task %
80 }

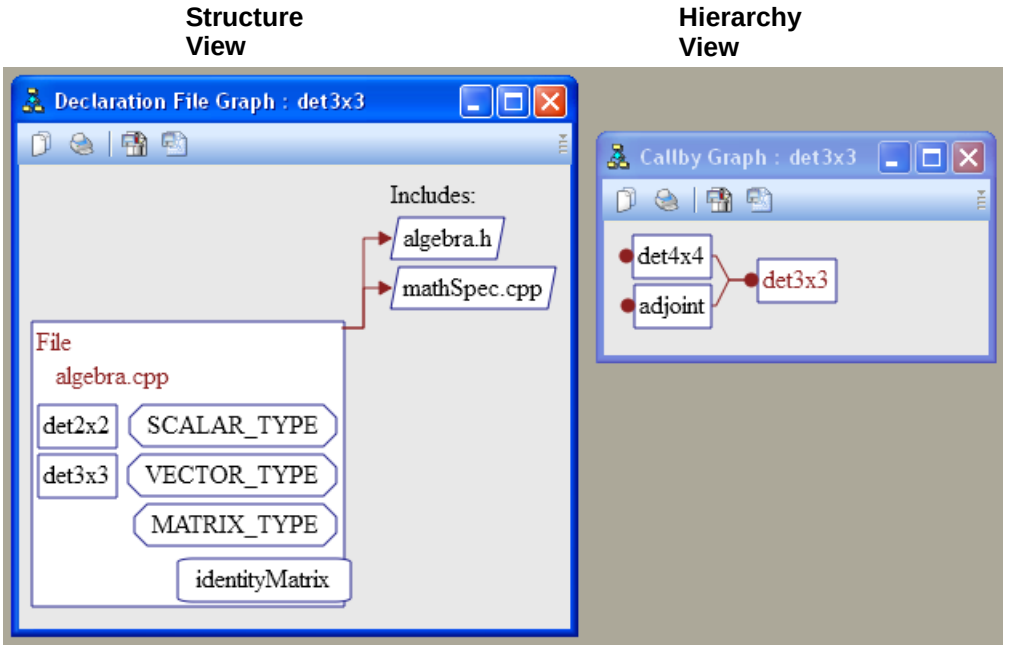
For details, see *About Snapshots* on page 8–2.

Graphical Views

Understand 2.0 analyzes your software code and creates a database containing information about the entities and the relations between entities. The database can then be browsed using various "graphical view" windows. The graphical views are divided into these kinds:

- **Hierarchy** views show relations between entities. Each view follows a relation (for instance "Calls") from the starting entity (that you inquired about) through its children and successors.
- **Structure** views quickly show the structure of any entity that adds to the structure of your software (for instance a package, function, procedure, or task).

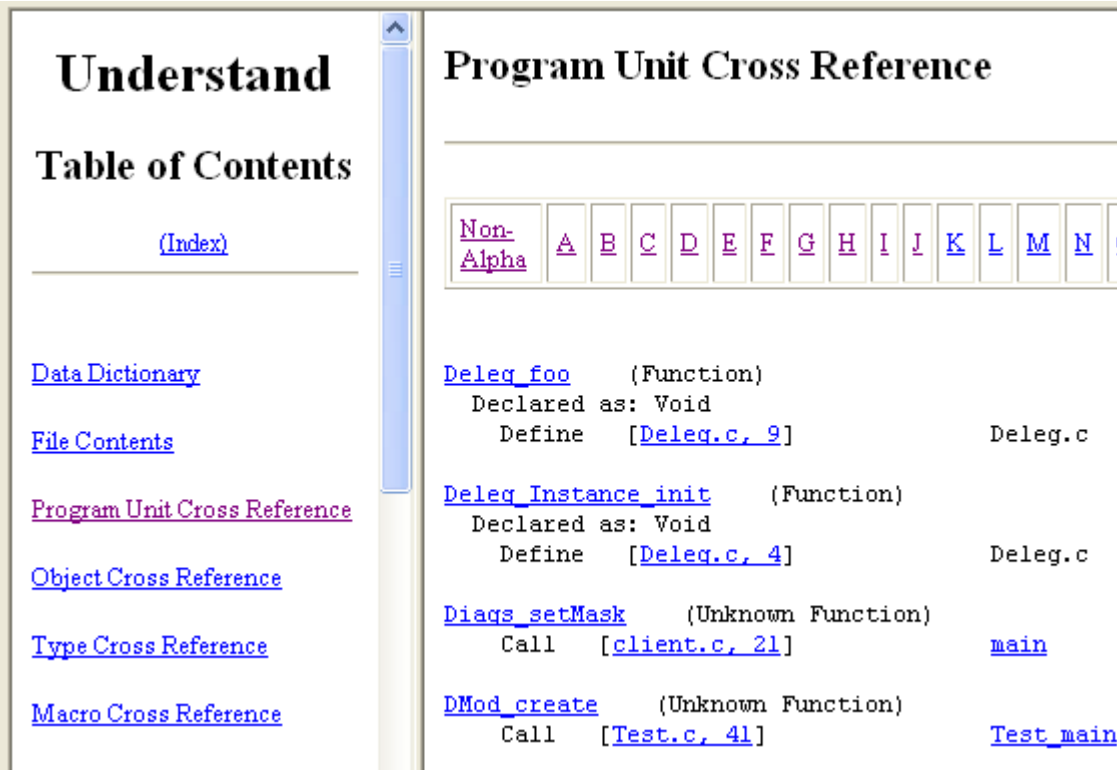
Examples of each type are shown in the following figure:



For details, See *Using Graphical Views* on page 9–1.

ASCII and HTML Reports

Views in *Understand 2.0* provide information about individual entities. The reports bundle information about all entities in ASCII or HTML format.



The HTML and ASCII reports also show information not available interactively, such as project metrics and quality reports. These reports are suitable for printing or browsing with a web browser.

See *Generating Reports and Metrics* on page 10–1 for more information.

PERL and C APIs for Custom Reporting

Understand 2.0 data is also available directly from scripts and programs that you (or we) write. A C API (usable from C, C++ or other languages that can call C libraries) and a PERL interface are available.

Using the API you have exactly the same access that we have when we write the existing GUI and report generators.

This manual doesn't cover the APIs. Choose **Help->PERL API Documentation** and **Help->FAQ** for more information.

Chapter 3 Configuring Your Project

This chapter shows how to create new *Understand 2.0* project files that you will use to analyze your source code.

This chapter contains the following sections:

Section	Page
About Understand 2.0 Projects	3–2
Creating a New Project	3–3
Project Configuration Dialog	3–7
Languages Category	3–9
Files Category	3–10
File Types	3–16
Metrics	3–17
Reports	3–19
Visual Studio	3–21
Ada Options	3–23
Assembly Options	3–27
C++ Options	3–28
C# Options	3–35
FORTRAN Options	3–36
Java Options	3–39
JOVIAL Options	3–41
Pascal Options	3–43
PL/M Options	3–45
Setting General Preferences	3–46
Analyzing the Code	3–59

About Understand 2.0 Projects

Understand 2.0 is like a compiler, except it creates information, not executable code.

In order for *Understand 2.0* to analyze your source code, it needs much of the information your compiler needs. It needs to know:

- What source files to analyze
- The type of source code
- The standard library paths and include directories
- Where to find Java .jar files that provide classes for which you do not have source code
- Compiler/environment specific macros that need to be defined for the pre-processor
- Application-specific macro definitions
- What implementation parameters (such as integer precision) and column truncation settings to use
- Any namespaces

If you developed the program or have been working with it for some time, this information is probably obvious to you. However, if you inherited this source code from another programmer, team, or company, you will probably have to examine the project building files (e.g. makefile) in order to come up with the information needed for accurate parsing of the code.

The easiest way to analyze your code is to use *Understand 2.0*'s GUI to build and parse a project.

The *Understand 2.0* Project Database

The *Understand 2.0* project database is stored in a proprietary binary format. The file format uses a network/object format that is optimized for storing *Understand 2.0* information.

Understand 2.0 databases have a file extension of **.udb**.

The project file permits multiple simultaneous read accesses, but it does not (yet) support multi-user write access.

Occasionally, a new feature to *Understand 2.0* requires a change to the database format. Such changes are noted in the Change Log. When you install a build that modifies the database format, existing projects are automatically reparsed when you open them.

Creating a New Project

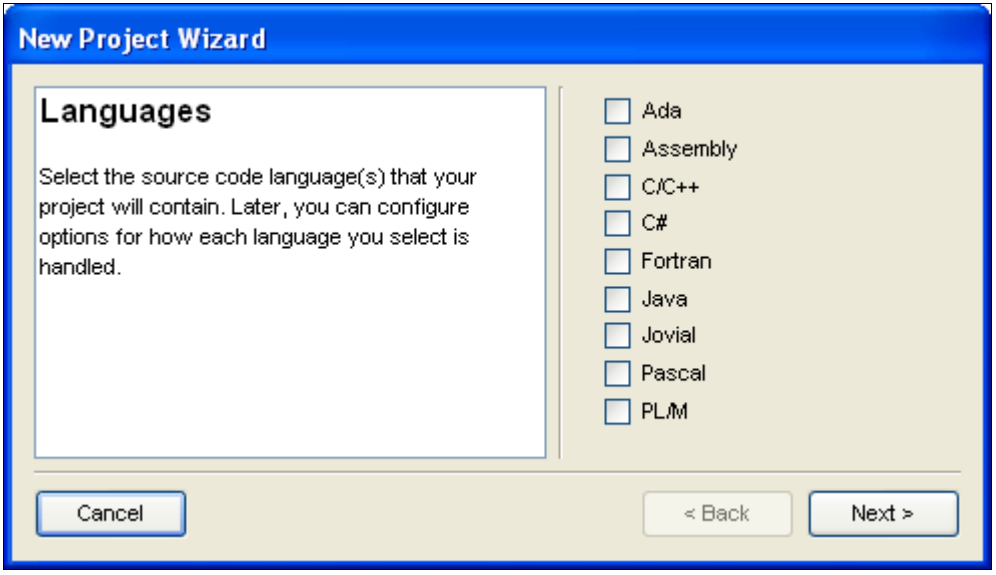
To begin analyzing code, you create a project and specify what source files to parse. *Understand 2.0* parses your code and creates a database you can browse. This database can be refreshed incrementally in the GUI or updated using command-line tools.

This section shows how to create a new project using the New Project Wizard. The project will be stored in a *Project Database*, which has a file extension of .udb.

You can open the New Project Wizard by clicking the **Create New Project** button in the Create/Open dialog that you see when you start *Understand 2.0*. Or, you can choose **File->New Project** from within *Understand 2.0*.

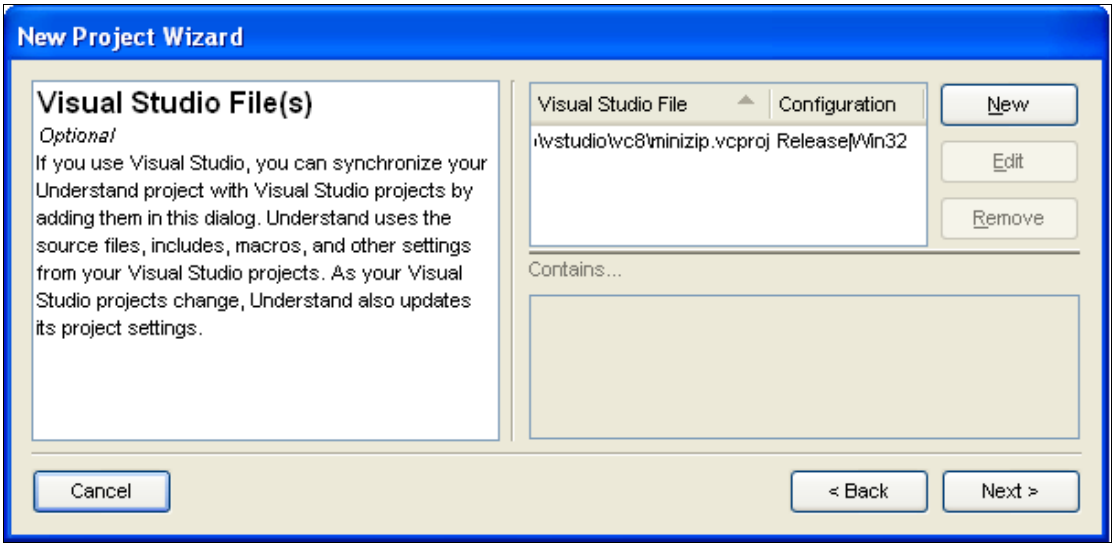
To use the New Project Wizard, follow these steps:

1. In the Create a project file page, click **Create as** and browse to the folder where you wish to create the project database.
2. Type the name of the project in the **File name** field. The .udb extension will be added automatically. Then click **Save**.
3. Click **Next** to see the Languages page of the wizard.



4. Put checkmarks next to languages used in the source code for this project. You can check multiple languages. See *Languages Category* on page 3–9 for more information. Then click **Next**.

5 If you use Visual Studio on Microsoft Windows, you can synchronize your Understand project with Visual Studio projects by clicking **New**.

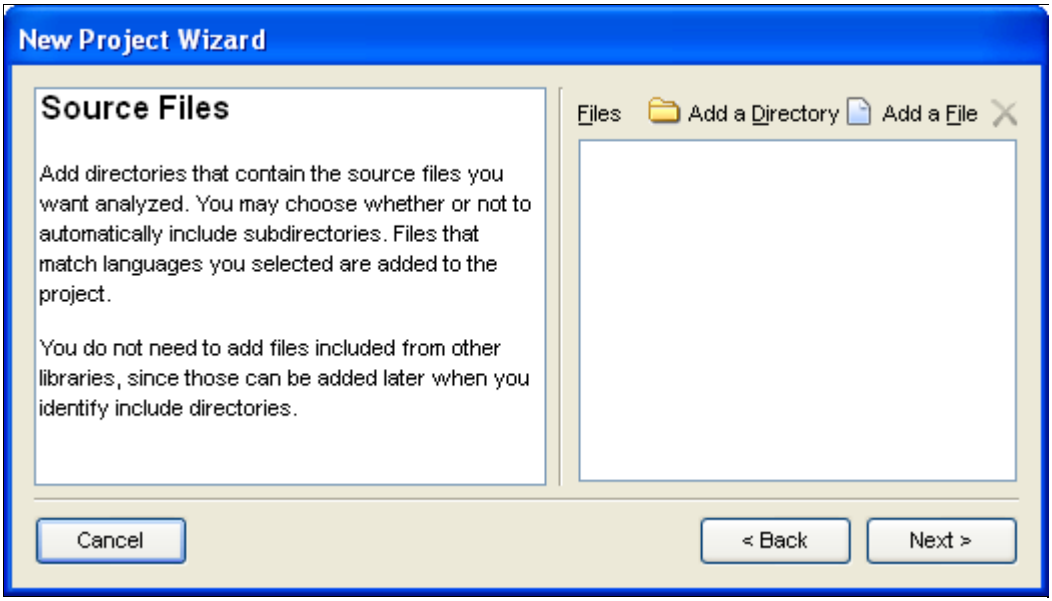

New Project Wizard
Visual Studio File(s)
Optional
If you use Visual Studio, you can synchronize your Understand project with Visual Studio projects by adding them in this dialog. Understand uses the source files, includes, macros, and other settings from your Visual Studio projects. As your Visual Studio projects change, Understand also updates its project settings.
Visual Studio File
Configuration
\vstudio\vc8\minizip.vcproj
Release|Win32
New
Edit
Remove
Contains...
Cancel
< Back
Next >

In the Add a new Visual Studio file dialog, click **...** and browse for your Visual Studio project file. In the Add a new Visual Studio file dialog, select the project configuration you want used when *Understand 2.0* analyzes your project. Then click **OK**.

You can add multiple Visual Studio projects or use the **Edit** button to change the Configuration setting. Then click **Next**.

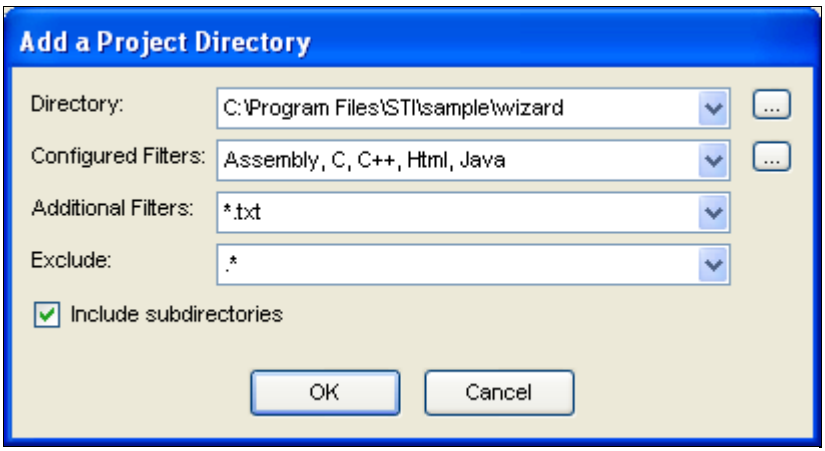
See *Visual Studio* on page 3–21 for more information.

6 To add source files to a project, you can click **Add a Directory** or **Add a File**.


New Project Wizard
Source Files
Add directories that contain the source files you want analyzed. You may choose whether or not to automatically include subdirectories. Files that match languages you selected are added to the project.
You do not need to add files included from other libraries, since those can be added later when you identify include directories.
Files
Add a Directory
Add a File
Cancel
< Back
Next >

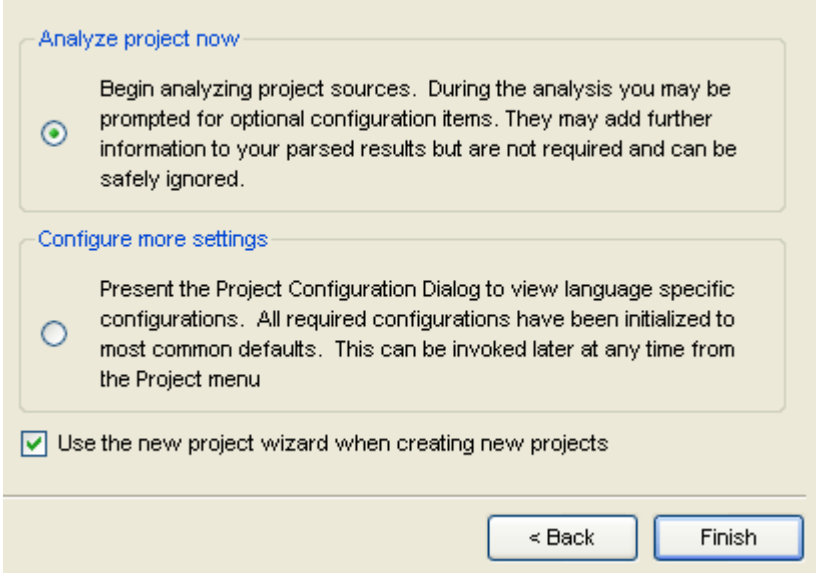
To add a file, just browse for the file and add it.

When you add a directory, you can browse for a directory, modify the list of languages used in the source files, add additional filters for file extensions not expected by *Understand 2.0*, filter out any files you want to exclude (for example, temp*.*), and choose whether all the subdirectories of this directory should be added. See *Adding Directories* on page 3–11 for details.



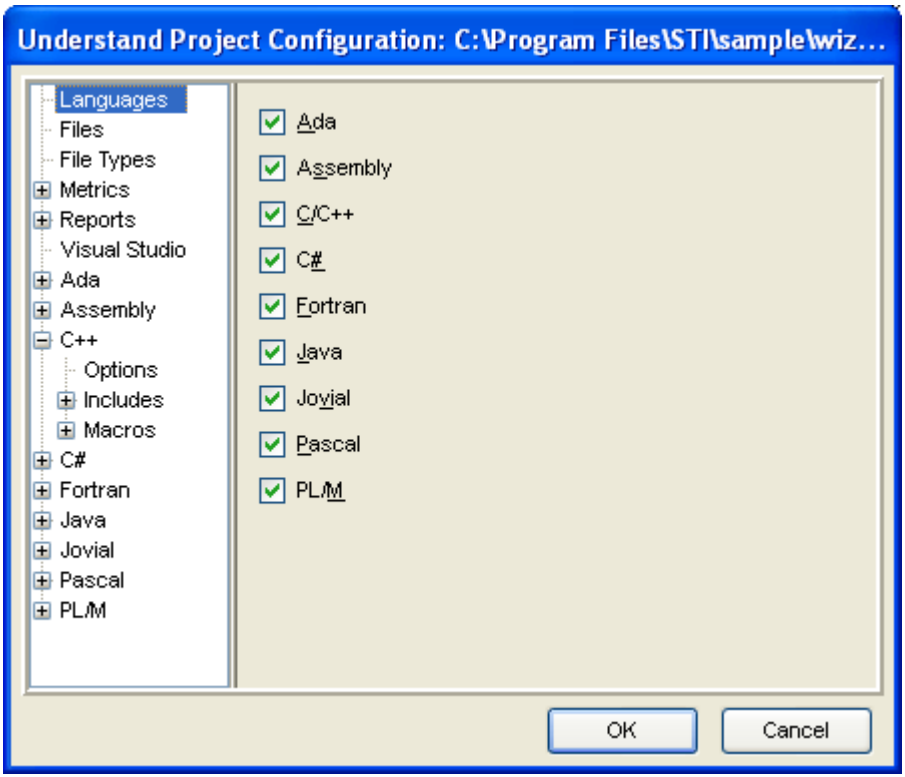
If you chose a Visual Studio project, those files are automatically listed in the Source Files page of the New Project Wizard.

7 Choose whether to **Analyze project now** or further configure the project. Choosing **Configure more settings** takes you to the Project Configuration dialog, which is described starting on page 3–7. In either case, you can go to the Project Configuration dialog anytime you like.


Analyze project now
Begin analyzing project sources. During the analysis you may be prompted for optional configuration items. They may add further information to your parsed results but are not required and can be safely ignored.
Configure more settings
Present the Project Configuration Dialog to view language specific configurations. All required configurations have been initialized to most common defaults. This can be invoked later at any time from the Project menu
Use the new project wizard when creating new projects
< Back
Finish

Project Configuration Dialog

The *Understand 2.0* Project Configuration dialog opens when you finish using the New Project Wizard or when you choose the **Project->Configure Project** menu item.



The categories on the left in the Project Configuration dialog allow you to specify various project settings to be used during analysis.

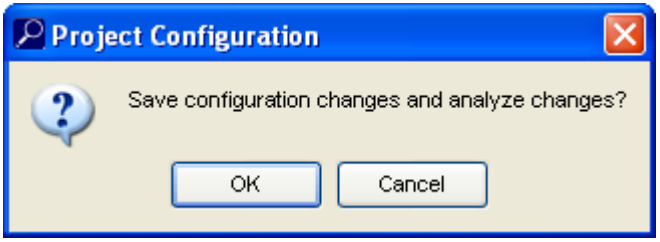
The Project Configuration dialog contains the following categories:

- **Languages** - Specify the types of languages to be parsed. For details, see *page 3–9*.
- **Files** - Specify the locations of source files to be analyzed. For details, see *page 3–10*.
- **File Types** - Specify how to handle source file types and what file extensions are used. For details, see *page 3–16*.

- **Metrics** - Specify the metrics you want computed for this project. For details, see *page 3–17*.
- **Reports** - Specify the reports you want generated for this project. For details, see *page 3–19*.
- **Visual Studio** - Specify a Visual Studio project to synchronize this *Understand 2.0* project with. For details, see *page 3–21*.
- **Language-Specific Options** - Specify options for the languages you selected in the Languages category. For details, see:
  - Ada Options, *page 3–23*
  - Assembly Options, *page 3–27*
  - C++ Options, *page 3–28*
  - C# Options, *page 3–35*
  - Fortran Options, *page 3–36*
  - Java Options, *page 3–39*
  - Jovial Options, *page 3–41*
  - Pascal Options, *page 3–43*
  - PL/M Options, *page 3–45*

After you have changed the project configuration, click the **OK** button and the configuration will be saved. **Cancel** closes the dialog without saving your changes.

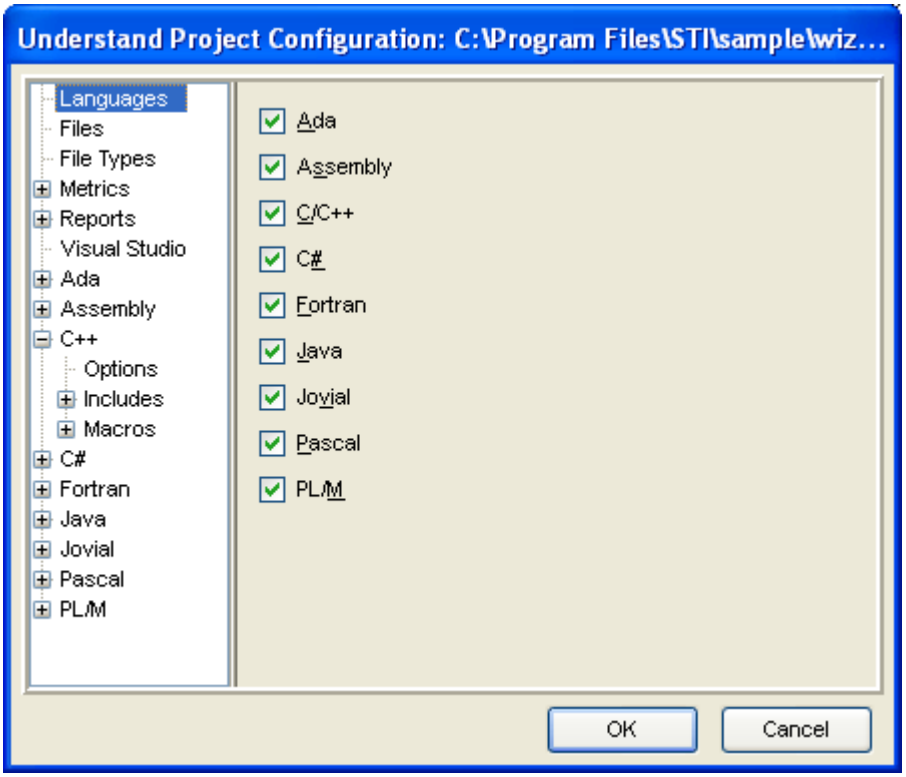
Whenever the files in the project configuration are modified, including at the time of project creation, a dialog alerting you to the change in configuration appears.



Choose “Yes” and *Understand 2.0* then begins parsing (that is, analyzing) the code.

Languages Category

In the **Languages** category of the Project Configuration dialog, you can check boxes for the languages used in your project. A project can contain source code in one or more languages.



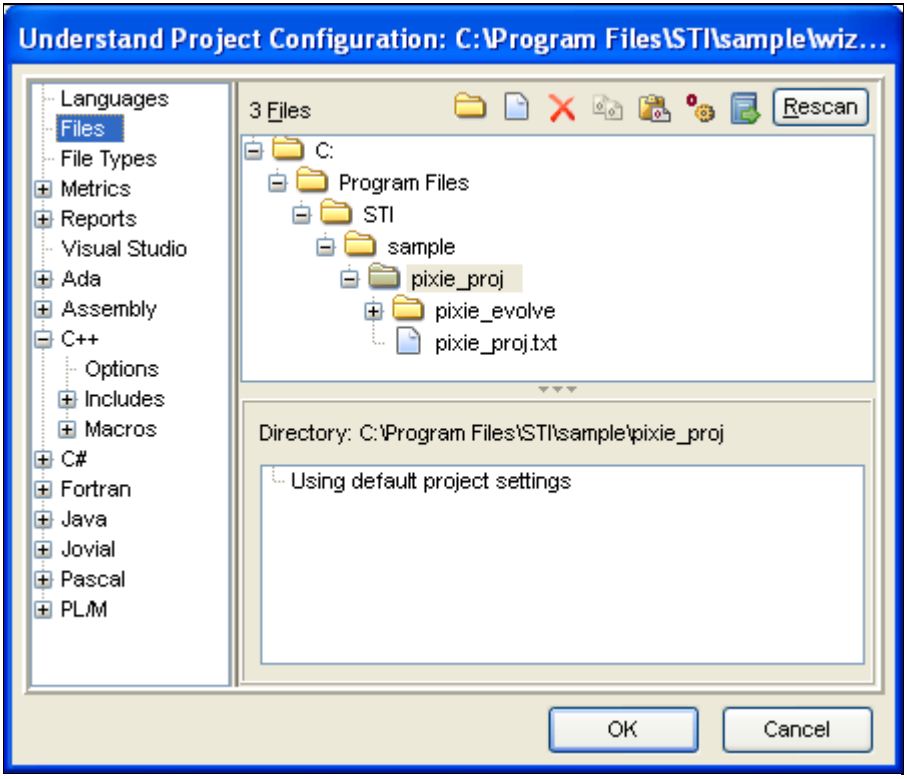
When you select a language, categories for that language are added to the list on the left in the Project Configuration dialog.

The languages you choose here not only affect how the source files are parsed. They also affect the filter types available, the metrics available, and the report types available.

If you select multiple languages, references between those languages are analyzed. For example, if C code calls an assembly function, that reference is shown.

Files Category

In the **Files** category of the Project Configuration dialog, you can add source code directory trees and/or individual files to the project. You can also delete specific files from the analysis and modify the language-specific options for individual directories and files.



You can add sources here, or you can tie the project to those specified in an MS Visual Studio project file (MS Windows versions of *Understand 2.0* only). See *Visual Studio* on page 3–21.

The top area shows the directories and files you have added in a tree that you can expand. It also shows how many files are currently in the project.

The bottom area shows any option overrides you have set for the selected directory or file.

Icons at the top of the dialog perform the following actions:

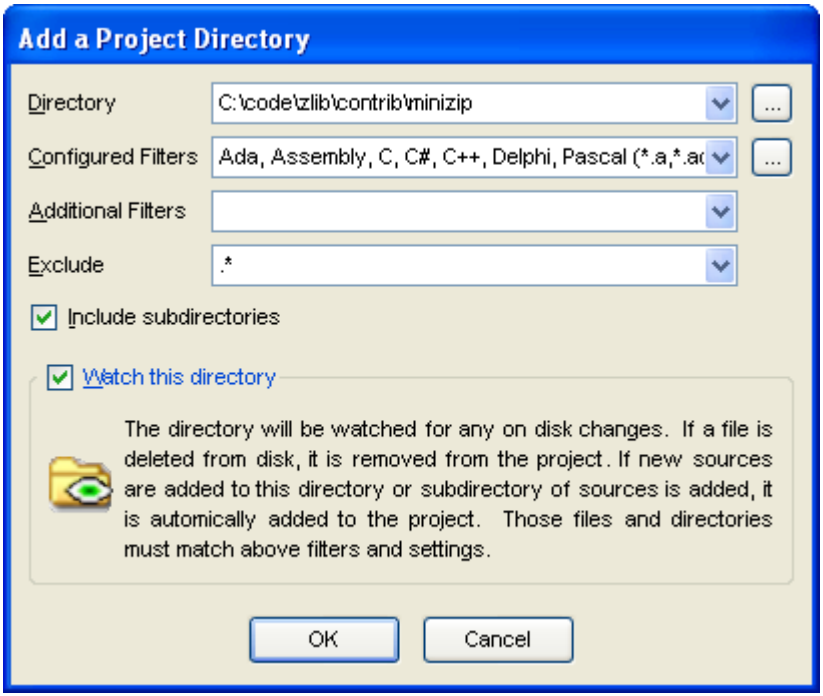
- Open the Add a Directory dialog.
- Open the Add a File dialog.
- Delete the selected directory or file from the project analysis.
- Copy the override settings for the selected directory or file.
- Copy the override settings to the selected directory or file.
- Configure override settings for the selected directory or file.
- Set portability options for file paths. See page 3–15.

Note that your changes are not saved until you click OK.

Click **Rescan** if you have added files to a directory that are not shown in the tree in this dialog.

Adding Directories

To add source directories to the project, click . You see the Add a Directory dialog:


Add a Project Directory
Directory
C:\code\zlib\contrib\minizip
Configured Filters
Ada, Assembly, C, C#, C++, Delphi, Pascal (*.a,*.ac
Additional Filters
Exclude
.*
Include subdirectories
Watch this directory
The directory will be watched for any on disk changes. If a file is deleted from disk, it is removed from the project. If new sources are added to this directory or subdirectory of sources is added, it is automically added to the project. Those files and directories must match above filters and settings.
OK
Cancel

1 In the **Directory** field, type the full directory path. Or, you can click the **...** button and use the Browse for Folder dialog to locate a directory containing source files and click **OK**.

2 In the **Configured Filters** field, click the **...** button if you want to add or delete languages from the list shown. In the Select Filters from Configured File Types dialog, put a checkmark next to any languages you want to be recognized as part of the project. Notice that additional languages are listed beyond those shown in the Languages category. These include JavaScript, MSDos Batch, Perl, Tcl, Text, and XML.

   If this directory contains source files with extensions that are not listed, click **Configure**. Also, see *File Types* on page 3–16. For example, you might add .a64 as an assembly file type.

3 In the **Additional Filters** field, type a pattern-matching string that matches only the files you want to keep in the analysis. For example, std*.* includes only files that begin with “std”.

4 In the **Exclude** field, type a pattern-matching string that matches files you want to exclude from the analysis. For example, temp*.* excludes all files that begin with “temp”.

5 To select and add multiple subdirectories to a project configuration, check the **Include subdirectories** box (on by default). This causes all source files matching the filter in all subdirectories of the specified path to be added to the project.

6 If you want this directory to be watched for any new files or deleted files, check the **Watch this directory** box. Whenever a source file is added to or deleted from this directory, the change is reflected in this project. Watched directories are indicated by a icon in the files list. Directories excluded from being watched are indicated by a icon. By default, the subdirectories of a watched directory are also watched. See page 3–13 for watch setting overrides.

7 On UNIX, you can choose whether symbolic links should be followed when adding files.

8 After you have specified the fields, click the **OK** button to add the source files in that directory to the project. You can click **Cancel** if the add file process is taking too long.

Tip: You may add files from multiple directory trees.

If you are using Microsoft Windows, you may drag and drop a directory, a file, or a selection of files, from another window into the Project Configuration dialog to add it to the project. If you drag a folder, the Add a Project Directory dialog opens automatically. If you drag an individual file, that file will be added to the project whether it matches the file filter or not.

All directory paths are absolute.

Adding Files

To add individual source files to the project, click . You see the Add a File dialog, which is a normal file-selection dialog.

Browse for and select a file or files. Then click **Open**. The file(s) are added to the project.

Deleting Directories and Files

To delete a directory or file from the project, select the items you want to delete and click .

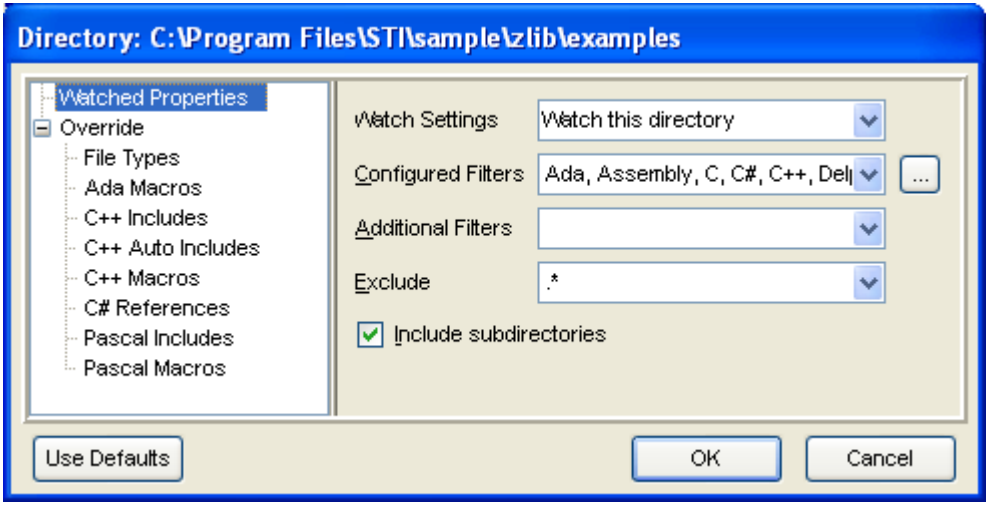
Setting Overrides

Normally, each file in the project is processed according to the rules you specify in the Project Configuration window for the language of the file. For example, for C++ you can set include directories and macro definitions. However, you can override the default settings on a directory-by-directory or file-by-file basis if you like.

Directory: To override settings for a directory, follow these steps:

1 Select a directory.

2 Click or right-click and select **Configure override settings**.



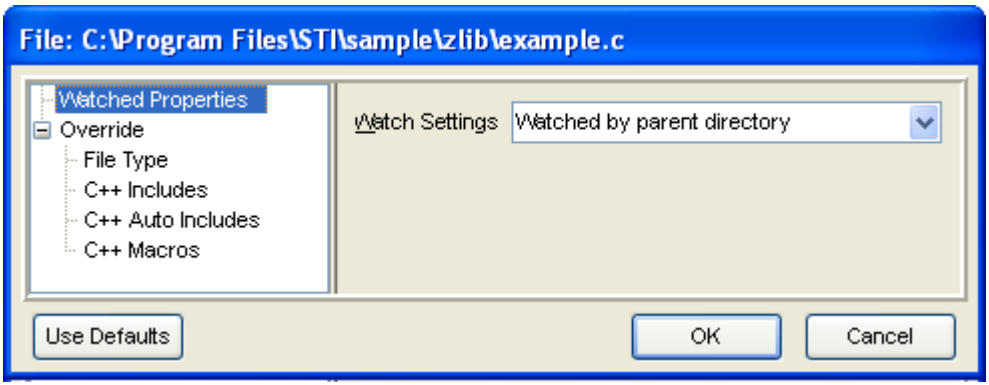
3 In the **Watched Properties** category, you can choose how files in this directory should be watched for new files to add to the project or deleted files to remove from the project. For **Watch Settings**, you can choose to watch a directory, not watch a directory, or inherit watch settings from the parent directory. In addition to specifying whether to watch a directory, you can set filters and exclude filters for an individual directory that control what types of new and deleted files will be found.

4 In the various **Override** categories, you can make directory-specific language-related settings.

File: To override settings for a file, follow these steps:

1 Select a file.

2 Click or right-click and select **Configure override settings**.



3 In the **Watched Properties** category, you can choose to have the file watched by its parent directory (if that directory is watched) or excluded from being watched.

4 In the various **Override** categories, select a category and make changes. The categories available are different depending on the language of the source file. See page 3–23 through page 3–45 for details.

The **File Type** category lets you override the language of this file indicated by the file extension.

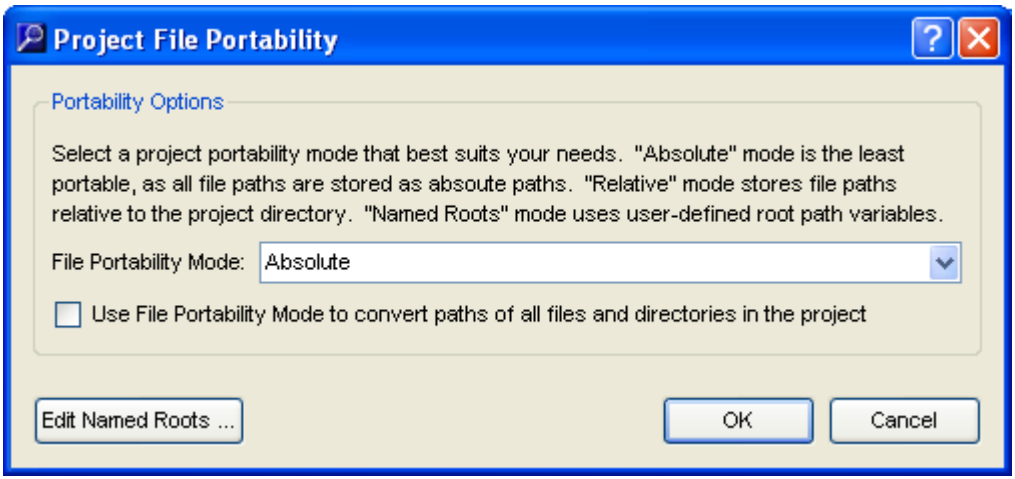
5 Click **OK** to save your overrides.

Scanning Watched Directories

If you set directories to be watched, you can scan those directories for new files to be added to the project or deleted files to be removed from the project by choosing **Project->Rescan Watched Project Directories**.

Setting File Portability

You can control the portability of *Understand 2.0* projects by clicking the icon at the top of the **Files** category of the Project Configuration dialog. You will see the following dialog.


Project File Portability
Portability Options
Select a project portability mode that best suits your needs. "Absolute" mode is the least portable, as all file paths are stored as absoute paths. "Relative" mode stores file paths relative to the project directory. "Named Roots" mode uses user-defined root path variables.
File Portability Mode:
Absolute
Use File Portability Mode to convert paths of all files and directories in the project
Edit Named Roots ...
OK
Cancel

A more portable project can allow you to share the project with other users and to use the project unchanged after moving the source code files.

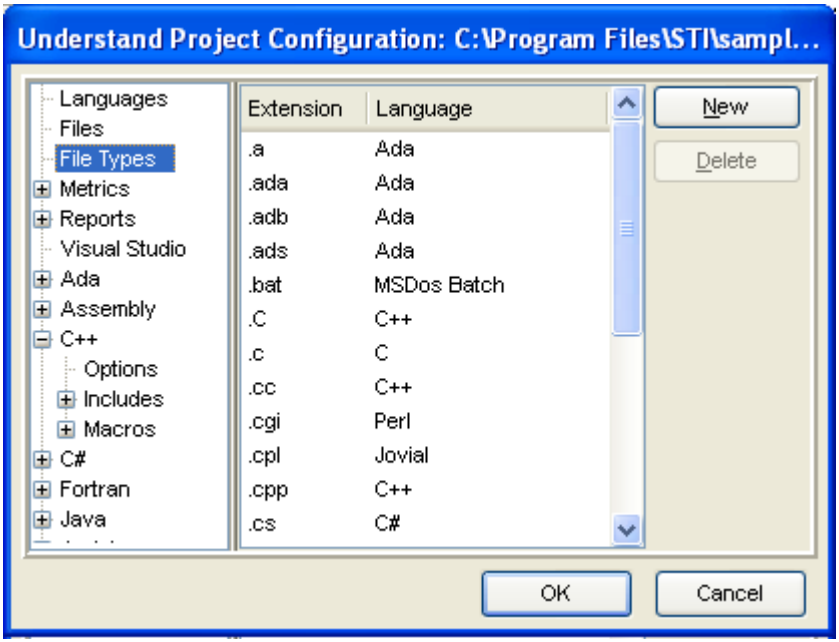
The choices are as follows:

- **Absolute.** This option is the default. It stores full file paths for all directories. If the source files change location, the paths will be incorrect.
- **Relative.** This option stores the relative path to directories from the location of the *Understand 2.0* project database. If you store the project database in the source file tree and move it along with the source files, the project can still be used.
- **Named Root.** This option allows you to specify “Named Roots” that are similar to environment variables to point to a root directory. Different users may then use different definitions for a named root. Click the **Edit Named Roots** button and see page 3–53 for details.

Check the **Use File Portability Mode to convert paths** box if you want the file paths currently stored in the project to be updated when you click **OK**.

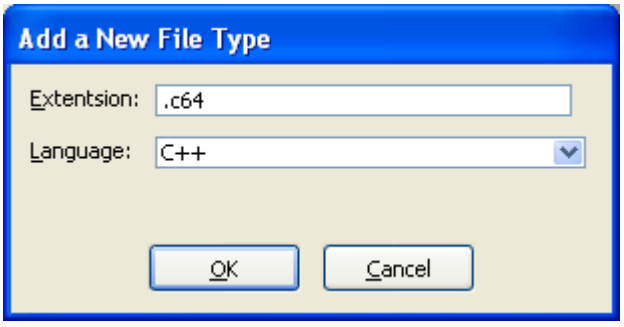
File Types

In the **File Types** category of the Project Configuration dialog, you can control how file extensions are interpreted by *Understand 2.0*.



The list shows all the file extensions already understood. Files with the types understood for the languages you checked in the Languages category are analyzed as part of the project. Other files are not analyzed.

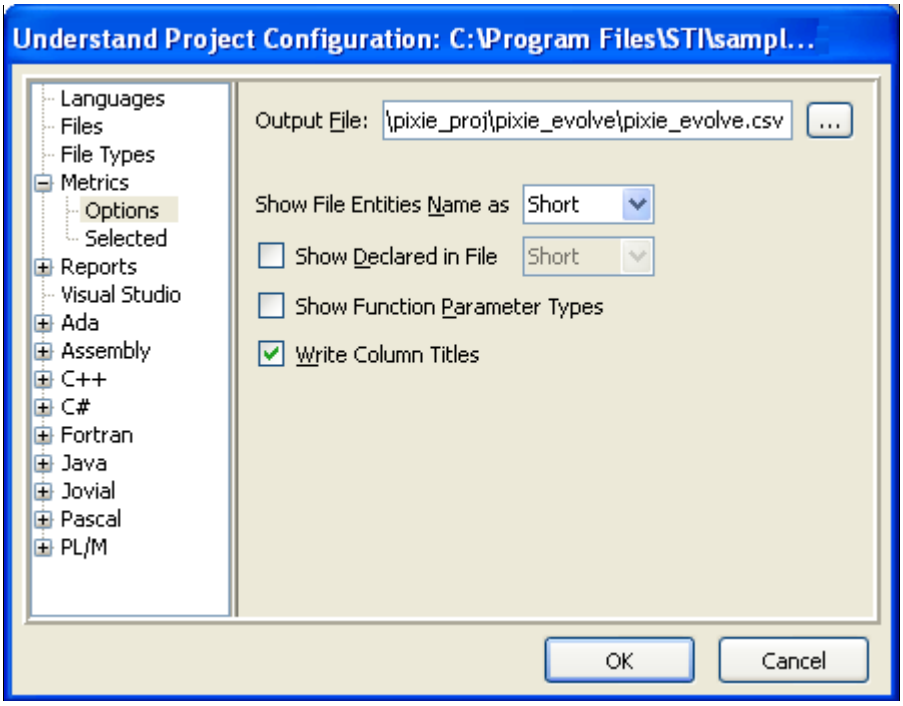
To add file extensions to this list, click **New**.



Type a file extension and select the language indicated by the file extension. Then click **OK**.

Metrics

In the **Metrics** category of the Project Configuration dialog, you can control how metrics are generated. The Metrics category has two sub-categories: **Options** and **Selected**.



You see this window when you choose the **Project->Configure Project** menu item and then the **Metrics** category. If you attempt to generate metrics before configuring metrics, this window opens automatically.

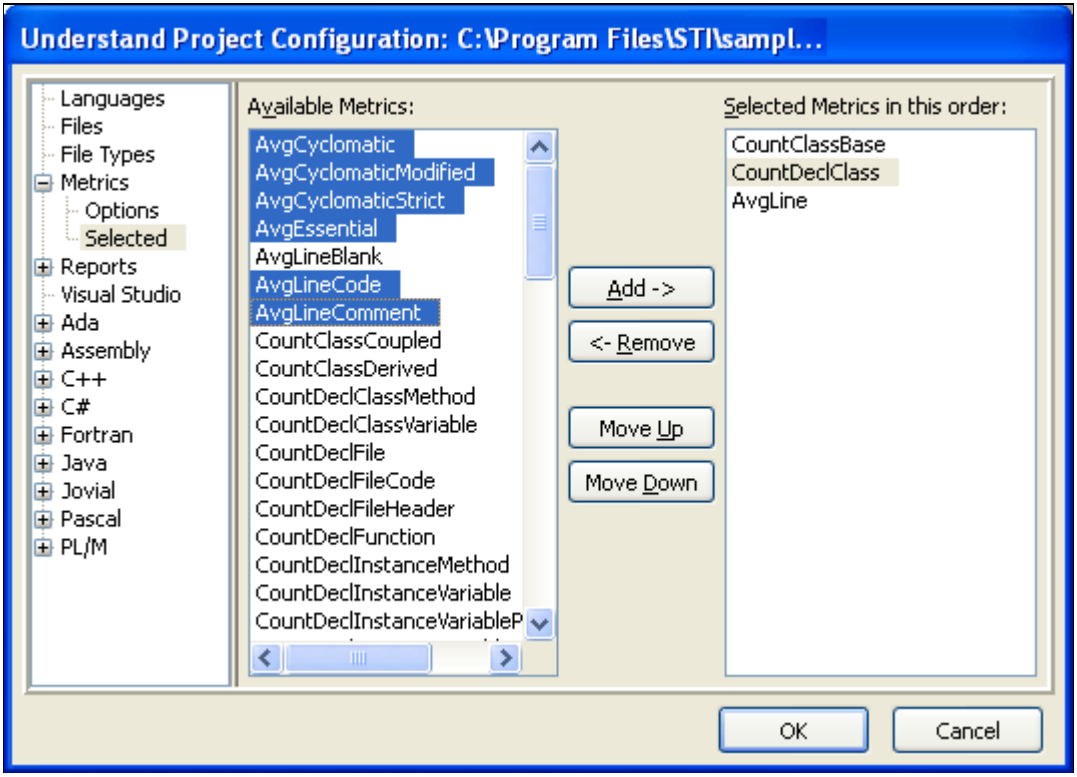
The **Options** subcategory has the following fields:

- **Output file.** Specify the location and name of the file you want to use for metrics output. *Understand 2.0* sends its metrics output to a .csv (comma-separated values) file. This file can be opened with Microsoft Excel and other spreadsheets.
- **Show File Entities Name as.** Specify whether files should be displayed with **Short** names (just the filename), **Full** names (including the absolute path), or **Relative** names (relative directory path).

- **Show Declared in File.** Check this box if you want the file in which each entity is declared to be included in the output. You can specify whether you want these files displayed with **Short** names, **Full** names, or **Relative** names.
- **Show Function Parameter Types.** Check this box if you want the type of each function parameter listed.
- **Write Column Titles.** Check this box if you want column headings in the CSV file.

Metrics->Selected Category

The **Selected** subcategory has lists like the following:

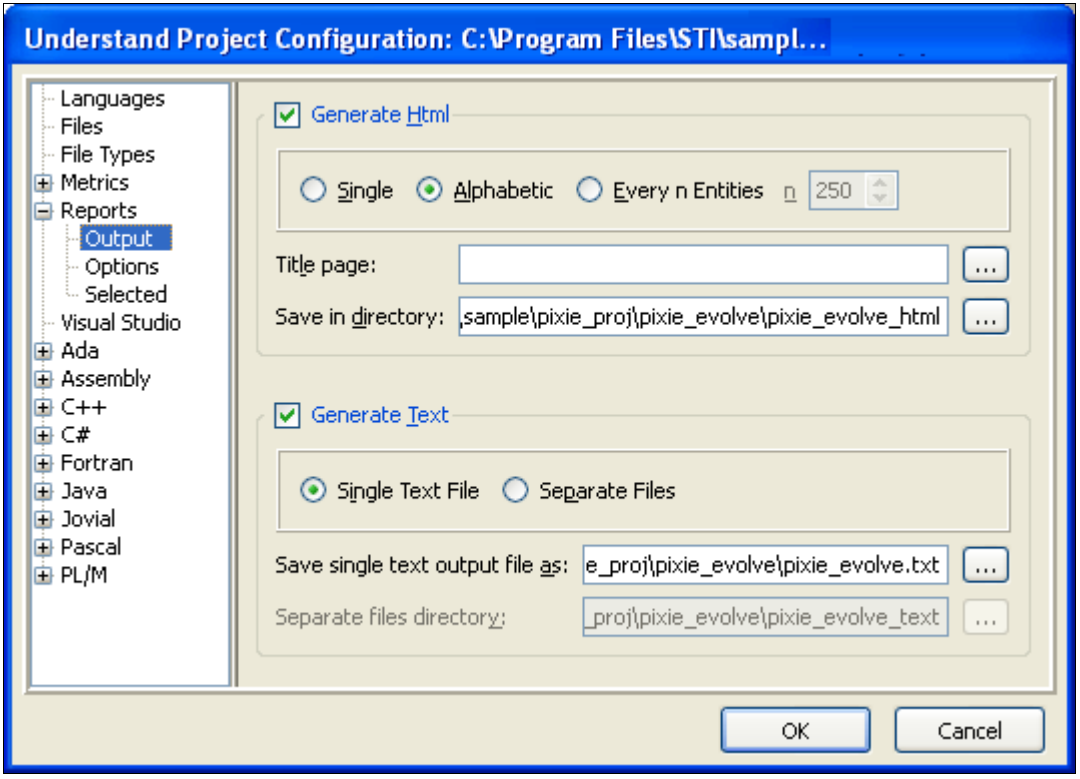


1. In the **Available Metrics** list (left), select metrics you want to include in the output you generate. You can hold down Shift to select a continuous group or Ctrl to select discontinuous items.
2. Click **Add** to copy the selected metrics to the right column.
3. You can reorder the metrics in the right column using the **Move Up** and **Move Down** buttons.

See the FAQs at www.scitools.com for descriptions of the metrics.

Reports

In the **Reports** category of the Project Configuration dialog, you can control how reports are generated. The Reports category has the following sub-categories: **Output**, **Options** and **Selected**.



You see this window when you choose the **Project->Configure Project** menu item and then the **Reports** category. You can also reach this window by clicking **Configure** in the Project Reports window.

Reports->Output Category

The **Output** subcategory has two main areas:

- **Generate HTML.** This option generates a large group of HTML files that are interlinked.
  - You may generate **Single** or multiple HTML files for each report type. It is recommended that you split up the files for large projects. Choose **Alphabetic** to generate multiple HTML files per report which are split up alphabetically by the first

letter of the entity name. Choose **Every n Entities** to generate multiple HTML files per report which are split up every “n” number of entities. By default, a single HTML file is generated for each letter of the alphabet.

- The “home” file for the reports is index.html, but you can select an alternate **Title Page**.
- The default **Save in directory** is the <*proj_file*>_html folder below the folder where your .udb file is stored, but you can select an alternate location.

- **Text reports.** This option generates simple text files containing the report data.
  - You may generate one text file of the specified location and name (by choosing **Single Text File**). Alternately, you may generate multiple text files (by choosing **Separate Files**) and specify a directory to contain all the files. The file extensions of each text file will denote the separate reports. Depending on which option you select, you can also select either a file or directory location for the output.

Reports->Options Category

The **Options** subcategory has the following fields:

- **Display full filenames.** If this box is checked, the invocation tree and metrics reports show full entity names. The default is to use short names.
- **Write generation time on report.** If this box is checked, the generation date and time are included at the top of text report files. This is on by default.

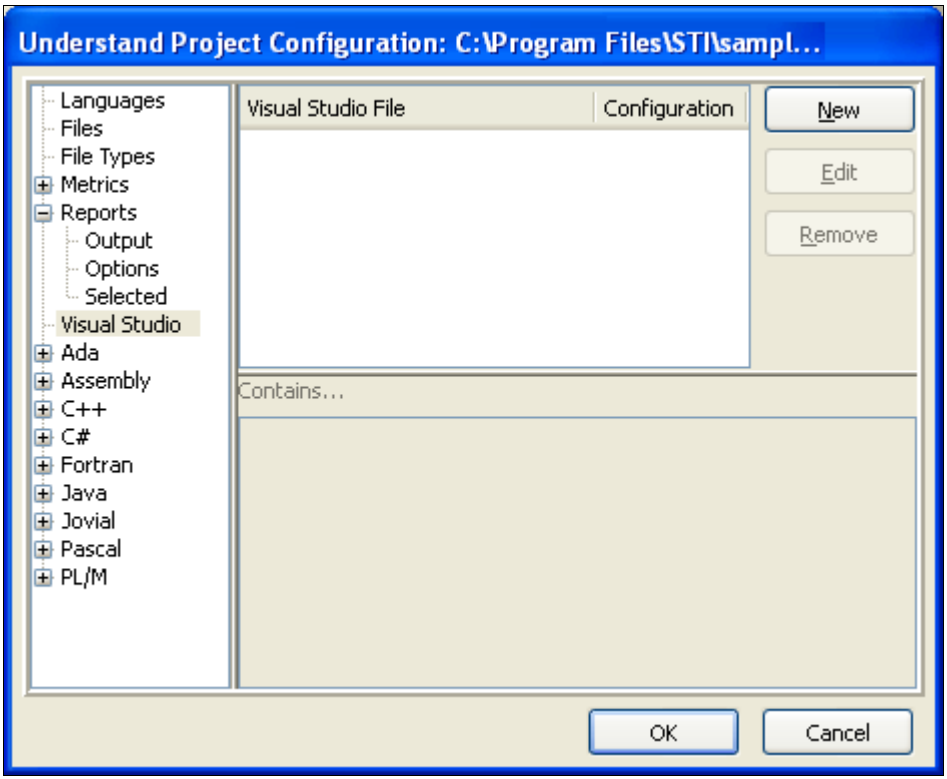
Reports->Selected Category

The **Selected** subcategory lets you check the boxes for the reports you want to generate. The list of reports differs depending on which languages are used in your project. See Chapter 10 for descriptions of these report formats.

Visual Studio

In the **Visual Studio** category of the Project Configuration dialog, you can tell *Understand 2.0* to use the source, macro, and include path settings from a Microsoft Studio project file.

You see this window when you choose the **Project->Configure Project** menu item and select the **Visual Studio** category.



Follow these steps:

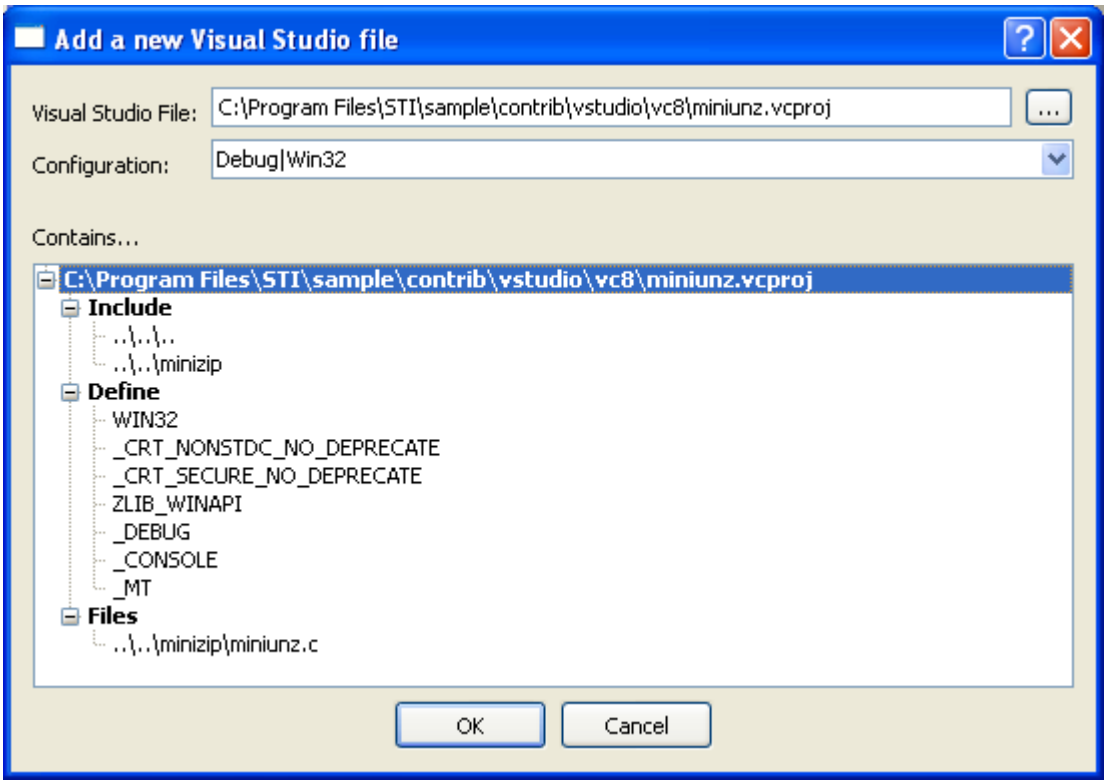
1 Click **New**.

2 In the **Add a new Visual Studio file** dialog, click the "..." button next to **Visual Studio File**. Then browse to select a Visual Studio project file and click **Open**. MS Visual Studio project files with extensions of .dsp, .dsw (workspace file), .sln, .vcp (Windows CE project), and .vcproj are supported.

3 Select the **Configuration** you want *Understand 2.0* to use when analyzing your project.

4 You can expand the **Contains** list to see the includes, defines, and files for the configuration currently selected.

Note: If you sync with a Visual Studio workspace file, the default target is used because there is no mechanism for specifying targets for each .dsp project within a .dsw file.



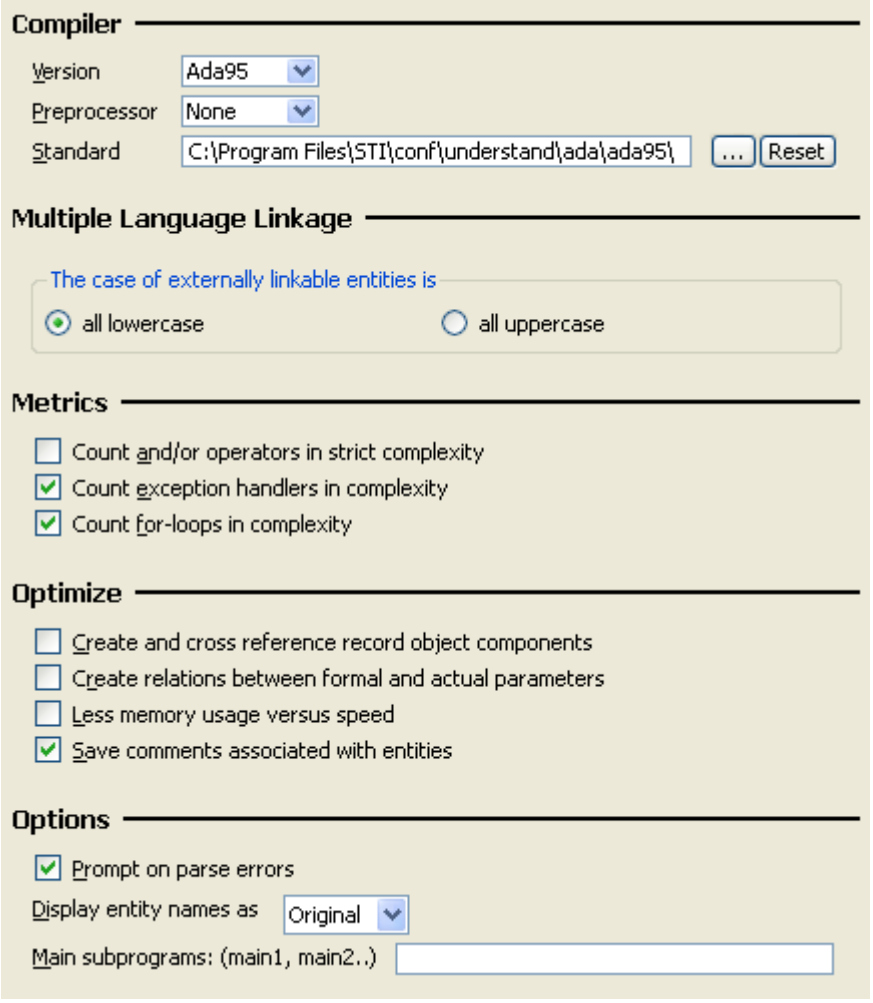
5 Click **OK** to add this to your project.

Once set, the source files, macros and include paths from the Visual Studio project are used by *Understand 2.0*. This is in addition to any project settings you configure in the other categories.

Note: Settings in other categories for include path and macros take priority over the Visual Studio project settings. This permits you to use the bulk of the Visual Studio settings while selectively overriding as your needs require.

Ada Options

In the **Ada->Options** category of the Project Configuration dialog, you can tell *Understand 2.0* how to analyze Ada source code. You see this window when you choose the **Project->Configure Project** menu item and select the **Ada** category.



The fields in this category are as follows:

- **Version.** Choose the version of Ada used in your project. *Understand 2.0* supports Ada 83, Ada 95, and Ada 05.
- **Preprocessor.** Choose which type of preprocessor statements are used in your Ada code. The choices are None, C, and Verdix.

- **Standard.** Choose the directory that contains the standard library used by this project. Default standards are provided within <install_directory>/conf/understand/ada.

  Sometimes it is helpful to parse code in context of its compilation environment rather than the environment defined as “Standard” in the Ada Language Reference Manual. This is most often needed when your compiler vendor offers bindings to other languages or low level attributes of a chip or system. To do so, place all the source files containing the Ada specifications for the new standard in one directory. Then point to this directory in the **Standard** field.

- **Case of externally linkable entities.** Choose which case should be used for “exporting” entities in this language that can be linked to (for example, called as functions) by other languages. For example, if an entity is declared in this language as “MYITEM” and you choose “all lowercase” here, other languages would be expected to call that entity as “myitem”.

- **Count and/or operators in strict complexity.** Place a check in this box if you also want “and” and “or” operators considered when calculating the strict complexity metric shown in the Program Unit Complexity report. Strict complexity is like cyclomatic complexity, except that each short-circuit operator (“and then” and “or else”) adds 1 to the complexity.

- **Count exception handlers in complexity.** If this box is checked (it is on by default), exception handlers are considered when calculating the complexity metrics shown in the Info Browser and the Program Unit Complexity report.

- **Count for-loops in complexity.** Remove the check from this box if you do not want FOR-loops considered when calculating the complexity metrics shown in the Info Browser and the Program Unit Complexity report. Complexity measures the number of independent paths through a program unit.

- **Create and cross-reference record object components.** If this box is checked (off by default), separate entities are created for each object that references a record type. By default, all such references are combined into one entity.

- **Create relations between formal and actual parameters.** Place a check in this box if you want the analysis to create relations between formal and actual parameters. The actual parameters linked to formal parameters include items used in expressions passed as actual parameters. This option is off by default to speed up analysis.

- **Less memory usage versus speed.** Place a check in this box if you want to use *Understand 2.0* in a very low memory consumption mode. In order to conserve memory, *Understand 2.0* frees memory used to process a program unit if that program unit is not needed. Using this option may slow down operation significantly. It is off by default.
- **Save comments associated with entities.** You can choose whether source code comments that occur before and after an entity should be associated with that entity.
- **Prompts on parse errors.** By default, you are prompted for how to handle errors that occur when analyzing files. When prompted, you may choose to ignore that error or all future errors. Turn this option off to disable this prompting feature. If you turned it off during analysis, but later want to turn error prompting back on, check it here.
- **Display entity names as.** Choose whether entity names should be displayed in *Understand 2.0* with the same case as the source code (original), all uppercase, all lowercase, only the first letter capitalized, or mixed case.
- **Main subprograms.** Provide a comma-separated list of the names of the main subprograms in the project.

Ada->Macros Category

Ada code may contain conditional compiler instructions in pragma statements. For example:

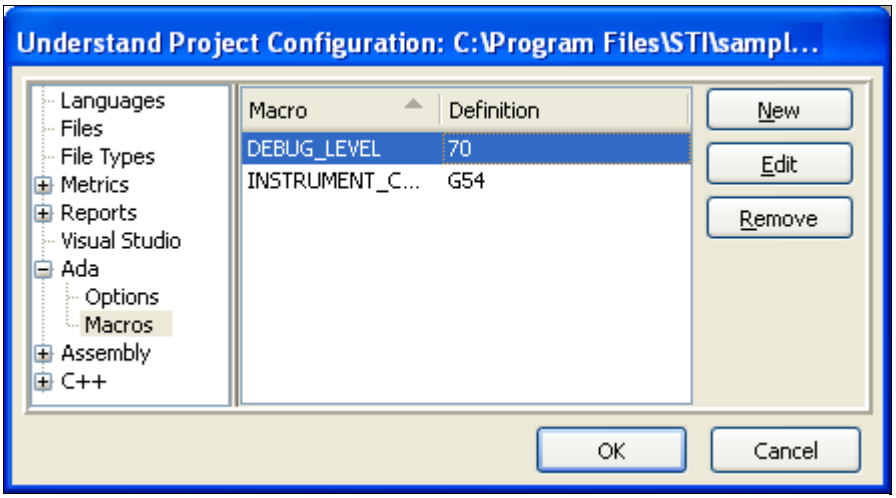
```
PRAGMA IF DEVICE == D129
```

The supported pragmas are IF, IFDEF, ELSIF, ELSE, and ENDIF. These pragmas are similar to preprocessor directives such as #ifdef in C code.

For *Understand 2.0* to successfully analyze your software it needs to know what macro definitions should be set.

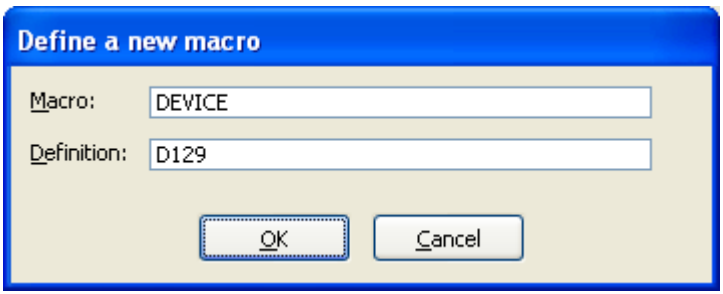
In the **Ada->Macros** category of the Project Configuration dialog, you can specify what macros to define for use with pragmas. You see this window when you choose the **Project->Configure Project**

menu item and select the **Ada** category and the **Macros** subcategory.



The Macros category lists macros and their optional definitions. Each macro may be edited or deleted.

To define a macro, click **New**.



Type the name of the macro in the first field and the definition (if any) in the second field. Then click **OK**.

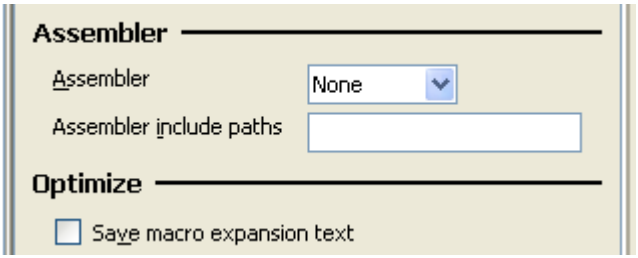
Note that a macro must have a name, but that the definition is optional. Macros that are defined but have no definition value are commonly used in conjunction with PRAGMA IFDEF statements to see if macros are defined.

To change the definition of an existing macro without changing the name, select the macro and click **Edit**.

You can set a macro on the und command line with the -define name[=value] option.

Assembly Options

In the **Assembly->Options** category of the Project Configuration dialog, you specify how to analyze assembly code. To see this, choose **Project-> Configure Project** and select **Assembly**.



The fields in the **Assembly->Options** category are as follows:

- **Assembler.** Choose the assembler to use for analyzing code. Currently, the Intel IA64 assembler is supported for Windows.
- **Assembler include paths.** Type the absolute path to files included by the assembly code.
- **Save macro expansion text.** Check this box if you want the expansions of macros to be stored to optimize future analysis.

Assembly->Includes Category

In the **Assembly->Includes** category you can click **New** and add a directory containing included files. The **Move Up** and **Move Down** buttons let you change the search order for directories you specify. The following fields are in the **Assembly->Includes** category:

- **Search for include files among project files.** Check this box if you want the directories you have added to the project to be searched for include files. This box is checked by default.
- **Treat system includes as user includes.** Check this box if you want system includes (#include <file>) to be searched for in the directories you list here. This box is checked by default.
- **Use case-insensitive lookup for includes.** Check this box if you want include files to be searched for case-insensitively.

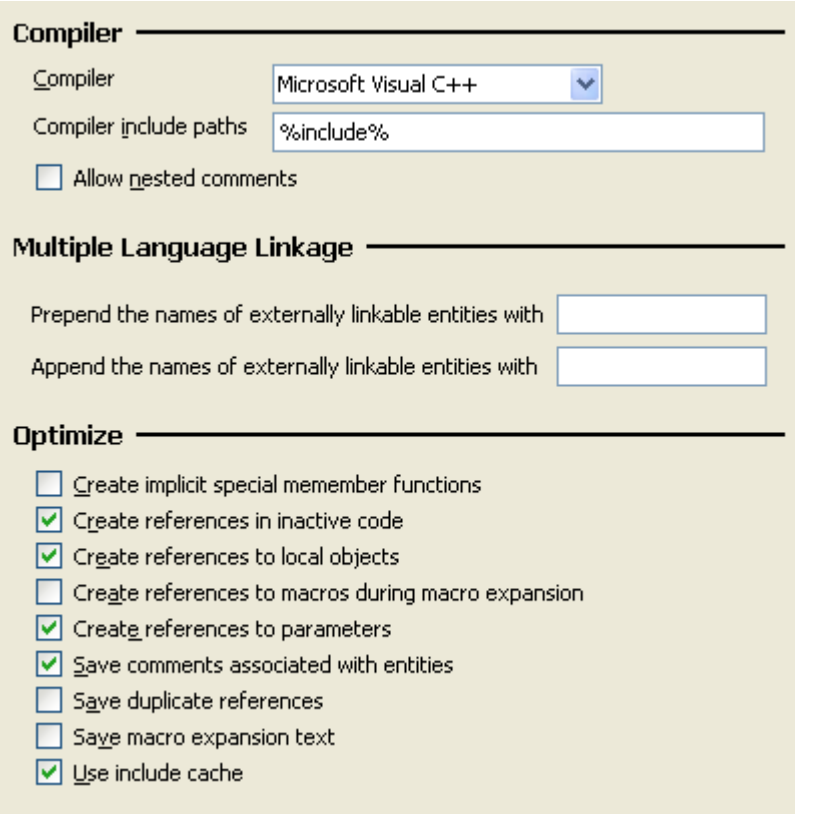
Assembly-> Includes ->Replacement Text Category

In the **Assembly->Includes->Replacement Text** category you can specify text that should be replaced in include file text. For example, you might use this feature to replace include paths like %somewhere% with specific paths without modifying the source code. See *C++->Includes-> Replacement Text* on page 3–32.

In the **Assembly->Macros** category you can add macro definitions. See *C++->Macros Category* on page 3–33.

C++ Options

In the **C++->Options** category of the Project Configuration dialog, you can tell *Understand 2.0* how to analyze C and C++ source code. You see this window when you choose the **Project->Configure Project** menu item and select the **C++** category.



The fields in the **C++->Options** category are as follows:

- **Compiler.** Select the compiler/platform that you use. This will set up compiler-specific macros for use by the *Understand 2.0* parser. Note that not all features of a particular compiler will necessarily be handled.
- **Compiler Include Paths.** Type the path the compiler uses to find include files. For example, %include%.
- **Allow nested comments.** By default, this is off. If turned on it permits C style (/* */) comments to be nested. This isn't permitted by the ANSI standard, but some compilers do permit it.

- **Prepend the names of externally linkable entities with.** You may optionally type a string that you want used as a prefix to reference all linkable entities in other source code languages.
- **Append the names of externally linkable entities with.** You may optionally type a string that you want used as a suffix to reference all linkable entities in other source code languages.
- **Create implicit special member functions.** Check this box if you want a default constructor and destructor to be created in the database and given implicit declaration references, if they are not declared in the source code for class and struct entities. This option provides entities for the parser to reference when they are called. The default is off.
- **Create references in inactive code.** If you wish to exclude cross-reference information for code that is IFDEFed out by the current macro settings, turn this option off. By default, this option is on and cross-reference information for inactive code is included.
- **Create references to local objects.** By default, all local object declarations are included in the database. If you wish to exclude variables declared within functions from the database, turn this option off. Local objects included for analysis can then be either included or excluded from the HTML output generated. Specify whether to include local objects in the HTML output on the main window of *Understand 2.0*.
- **Create references to macros during macro expansion.** Checking this box causes references to be stored during macro expansion. In some cases this is useful. Be aware that enabling this option can add a lot of references and makes the database large and slower. The default is off.
- **Create references to parameters.** If you wish to exclude cross-reference information for parameters, turn this option off. By default, this option is on and all cross-reference information for parameters is included.
- **Save comments associated with entities.** You can choose whether source code comments that occur before and after an entity should be associated with that entity.
- **Save duplicate references.** By default, duplicate cross-references are condensed to a single cross-reference. To keep duplicates, check this box.

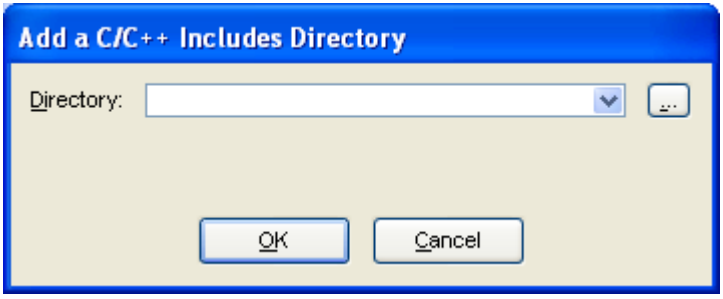
- **Save macro expansion text.** If you put a check in this box, you can right-click on a macro and choose **Expanded Macro Text** from the pop-up menu to see how the macro expands.
- **Use include cache.** By default, include files are cached during the analysis phase as they are often referenced in multiple source files. This speeds up analysis, but also uses more memory. If you have problems with excessive memory use during analysis, turn this option off. Note that there are also situations where turning the include cache on or off can affect analysis results, particularly where include actions are dependent on where they are included.

C++->Includes Category

The **C++->Include** category in the Project Configuration dialog (which you open with **Project->Configure**) allows you to specify include directories. You can specify multiple directories to search for include files used in the project.

Include paths are not recursively searched; that is, any subdirectories will not be searched for include files unless that subdirectory is explicitly specified in the list of include directories.

To add a directory, click the **New** button and then the **...** button, browse to the directory, and click **OK**.



During analysis, the include directories will be searched in the order that they appear in the dialog. You can click **Move Up** or **Move Down** to change the order in which directories will be searched.

Typically only include files that are not directly related to your project (such as system-level includes) and that you do not want to analyze fully are defined here. For project-level includes that you want to be analyzed, add those include files as source files in the **Sources** category.

You may use environment variables in include file paths. Use the $var format on UNIX and the %var% format on Windows.

Tip: If you have a lot of include files or they are generated by another process, you can add include files in bulk by specifying a file prefixed by an @ sign. For example, “@mydefs.txt”. This file should contain a list of directories in the desired search order:

```
/usr/include/X11
/home/nelson/GUI
```

Any relative paths are relative to the project file.

The **C++->Include** category provides the following options to control how includes are handled:

- **Add found include files to source list.** Enabling this option causes include files found during project analysis to be added to the project automatically. This allows you to see more detailed information about such include files. The default is off.
- **Add found system include files to source list.** If you choose to add include files that are found to the source list, you can also choose whether system include files should be added. The default is off.
- **Prompt for missing includes.** By default, for any include files that cannot be found during analysis, you will be prompted for how to handle that missing file. When prompted during analysis, you may choose to ignore the missing file, or you may specify the path where the file can be found. Turn this option off to disable this prompting feature. Any missing include files found during analysis when the prompt feature is turned off will be ignored.
- **Search for include files among project files.** This option directs the parser to look among project files as a last resort for missing include files. The default is on.
- **Treat system includes as user includes.** This option tells the parser to look for system includes (surrounded by < >) using the same strategies as normal includes (surrounded by quotes). If this item is off, the parser looks for system includes only in directories defined by the compiler configuration. The default is on.
- **Use case-insensitive lookup for includes.** This option tells the parser whether to ignore the case of filenames in #include statements. The default is off.

C++->Includes->Auto Category

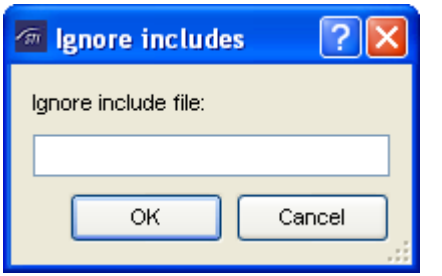
In the **C++->Includes->Auto** category you can specify include files that should be included before each file in a project.

To add a file, click the **New** button and browse for the file. Then click **Open**.

C++->Includes-> Ignore Category

In the **C++->Includes->Ignore** category you can specify individual include files that you wish to ignore during analysis.

To add a file to be ignored, click the **New** button and type the filename of the include file. Then click **OK**. The filename can use wildcards, such as moduleZ_*.h, to match multiple files.



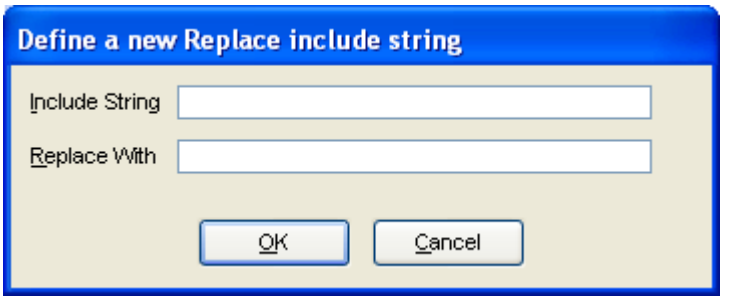
Any missing files you choose to ignore when prompted during analysis will be added to this list.

C++->Includes-> Replacement Text

In the **C++->Includes->Replacement Text** category you can specify text that should be replaced in include file text.

For example, you might use this feature to replace VAX/VMS include paths like [sys$somewhere] with valid UNIX or Windows paths without modifying the source code.

To add an item, type the string found in the actual include files in the **Include String** field. Type the text you want to replace it with in the **Replace With** field. Then click **OK**.



C++->Macros Category

C source code is often sprinkled with pre-processor directives providing instructions and options to the C compiler. Directives such as the following affect what the software does and how it should be parsed:

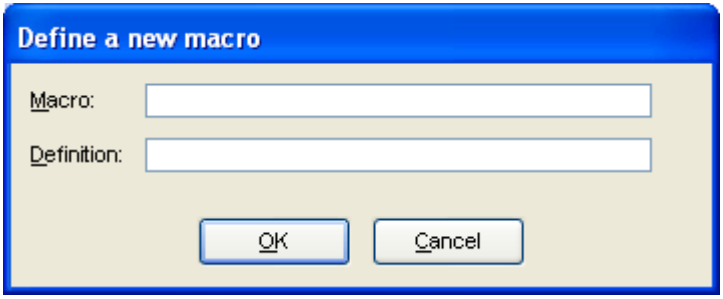
```
#define INSTRUMENT_CODE
#ifdef INSTRUMENT_CODE
... statements ...
#endif
```

Macros are often defined with directives (#define) in include files (.h files) or are passed in via the compiler (typically with the -D option).

For *Understand 2.0* to successfully analyze your software it needs to know what macro definitions should be set.

The **C++->Macros** category in the Project Configuration dialog (which you open with **Project->Configure**) allows you to define preprocessor macros that are used when compiling the code.

To add a macro definition, click the **New** button and type the name of the macro and optionally a definition. Then click **OK**.



Note that a macro must have a name, but that the definition is optional. Macros that are defined but have no definition value are commonly used in conjunction with *#ifdef* pre-processor statements to see if macros are defined.

Note: A number of preprocessor macros are automatically supported. In additions to the common macros, *Understand 2.0* supports the following macro formats for embedded assembly code:

```
#asm(<embedded assembly code>);
#asm "<embedded assembly code>";
#asm
<embedded assembly code>
#endasm
```

Tip: If you have a lot of macros or they are generated by another process, you can add macros in bulk by specifying a file prefixed by an @ sign. For example, type “@mydefs.txt” in the Macro field and click **OK**. This file should contain macro definitions in any of the following formats:

```
#define foo bar
foo=bar
foo bar
```

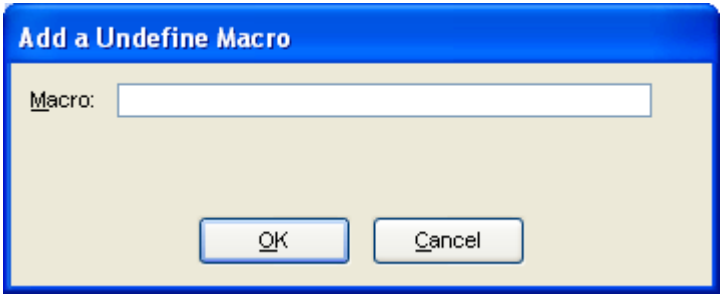
All of these formats define a macro “foo” to be “bar”.

The priority for macro definitions is as follows, from lowest to highest priority:

1. Built-in language macros (__FILE__, etc.)
2. Compiler configuration file
3. Macro definitions in a synchronized Visual Studio project
4. Undefines of compiler defines (via the **Configure Undefines** button)
5. Project defines (Macros category)
6. Define on undc command line using -define
7. Define in source file (#define / #undefine in source)

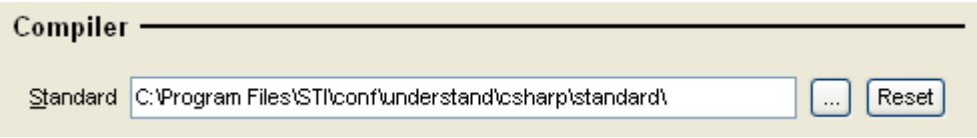
C++->Macros->Undefines Category

You can list undefined macros in the **C++->Macros->Undefines** category in the Project Configuration dialog. Click **New** and type the name of a macro that is not defined. Then click **OK**.



C# Options

If your source code uses C#, you can set the following C# specific option in the **C#->Options** category of the Project Configuration window:

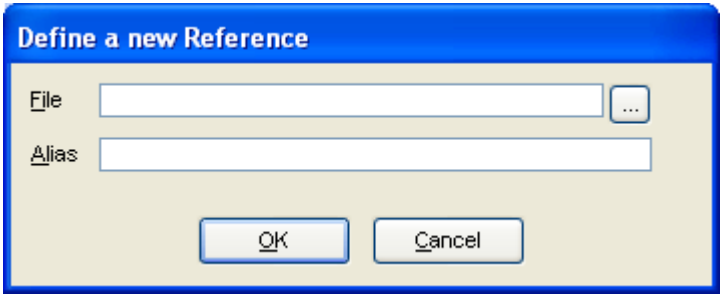


In the **Standard** field, click **...** and browse for the standard directory used by the compiler. A copy of the standard library is included in the *Understand 2.0* installation.

The C/C++ options do not apply to C# code.

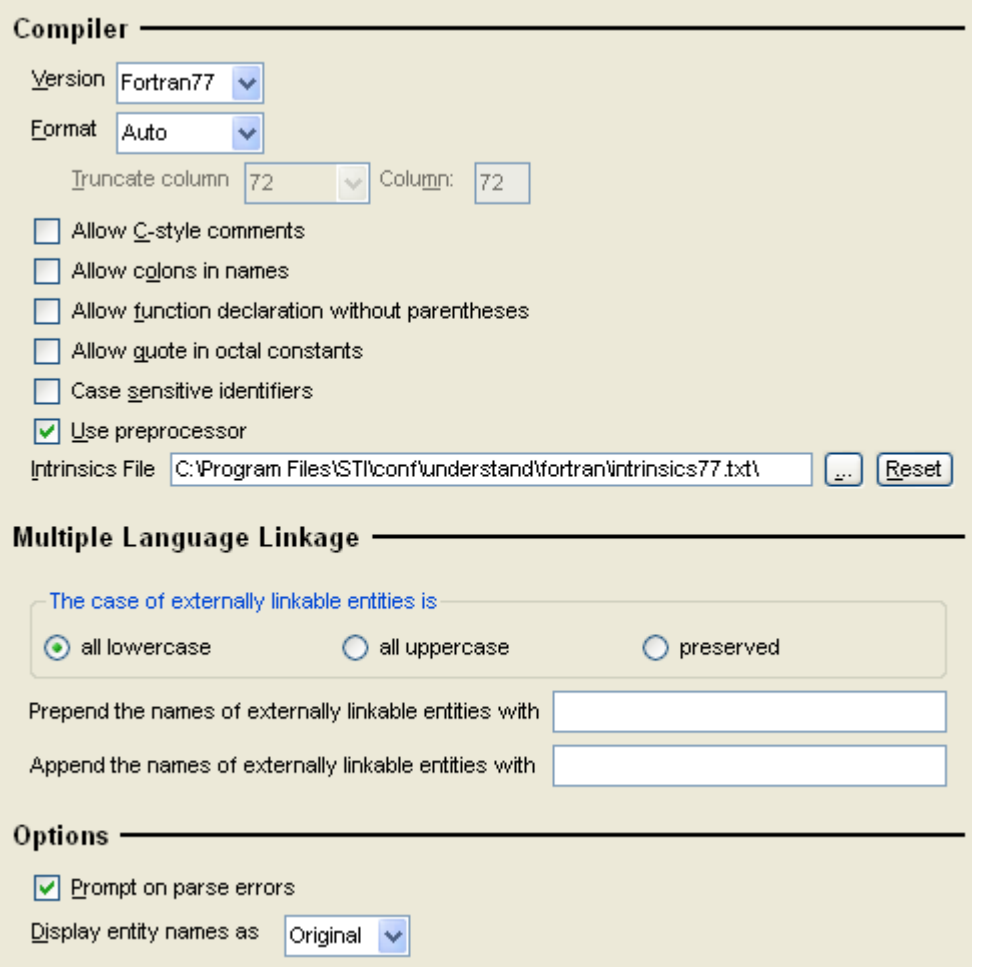
C#->References Category

In the **C#->References** category, click **New**. Click **...** and browse for a .dll file. Then type the alias for that file used in the code and click **OK**.



FORTRAN Options

In the **Fortran->Options** category of the Project Configuration dialog, you can specify how to analyze FORTRAN source code. You see this window when you choose the **Project->Configure Project** menu item and select the **Fortran** category.



The fields in the **Fortran->Options** category are as follows:

- **Version.** Select the variant of FORTRAN used by the source code in this project. If you change the version after creating a project, the project will be reanalyzed when you click OK. The choices are FORTRAN 77, FORTRAN 90, or FORTRAN 95. If you have a mix of code, choose the newest language variant. That is, if you have F77 and F95 code, choose F95.

- **Format.** Some older FORTRAN variants and all new variants permit *free form* statements, which may cross lines). Fixed form statements are terminated by a line end or column number. The default is “auto format,” which automatically detects the parsing format (fixed or free) on a file-by-file basis. This allows you to mix free and fixed format. Auto format also determines the correct truncation point for fixed format files. Choose “fixed” or “free” only if all your source files have the same format.
- **Truncate column.** If you choose fixed form, you may also choose what column terminates statements. Common columns 72 and 132 are available or you may specify a column or no truncation.
- **Allow C-style comments.** Check this option if your FORTRAN code contains comments of the form /* ... */.
- **Allow colons in names.** Check this box to allow colons (:) used in identifiers in F77 code. Enabling this option could cause problems in F77 code that does not use this extension, so the default is off.
- **Allow function declaration without parentheses.** Check this box if you want to allow functions to be declared without the use of parentheses. By default, parentheses are required.
- **Allow quote in octal constants.** Check this box if a double quote mark (") should be treated as the start of a DEC-style octal constant. For example, "100000. If this box is not checked (the default), a double quote mark begins a string literal.
- **Case sensitive identifiers.** Check this box if you want identifier names to be treated case-sensitively. By default, the case is ignored.
- **Use preprocessor.** Use this option to disable or enable preprocessor support.
- **Intrinsics file.** Type or browse for a file that contains intrinsic functions you want to be parsed. Default intrinsics files are provided in the <install_directory>/conf/understand/fortran directory: intrinsics77.txt, intrinsics90.txt, and intrinsics95.txt.
- **Case of externally linkable entities.** Choose which case should be used for “exporting” entities in this language that can be linked to (for example, called as functions) by other languages. For example, if an entity is declared in this language as “MYITEM” and you choose “all lowercase” here, other languages would be expected to call that entity as “myitem”.

- **Prepend the names of externally linkable entities with.** You may optionally type a string that you want used as a prefix to reference all linkable entities in other source code languages.
- **Append the names of externally linkable entities with.** You may optionally type a string that you want used as a suffix to reference all linkable entities in other source code languages.
- **Prompt on parse errors.** By default, parsing errors cause a prompt asking how to handle that error. When prompted during analysis, you may choose to ignore that error or all future errors. Turn this option off to disable this prompting feature. If you turned it off during analysis, but later want to turn error prompting back on, check it here.
- **Display entity names as.** Choose whether entity names should be displayed in *Understand 2.0* with the same case as the source code (original), all uppercase, all lowercase, only the first letter capitalized, or mixed case.

Fortran>Includes Category

The **Fortran->Include** category in the Project Configuration dialog (which you open with **Project->Configure**) allows you to specify include directories. You can specify multiple directories to search for include files used in the project.

Include paths are not recursively searched; that is, any subdirectories will not be searched for include files unless that subdirectory is explicitly specified in the list of include directories.

To add a directory, click the **New** button and then the **...** button, browse to the directory, and click **OK**.

During analysis, the include directories will be searched in the order that they appear in the dialog. You can click **Move Up** or **Move Down** to change the order in which directories will be searched.

Typically only include files that are not directly related to your project (such as system-level includes) and that you do not want to analyze fully are defined here. For project-level includes that you want to be analyzed, add those include files as source files in the **Sources** category.

For more information, see *C++->Includes Category* on page 3–30.

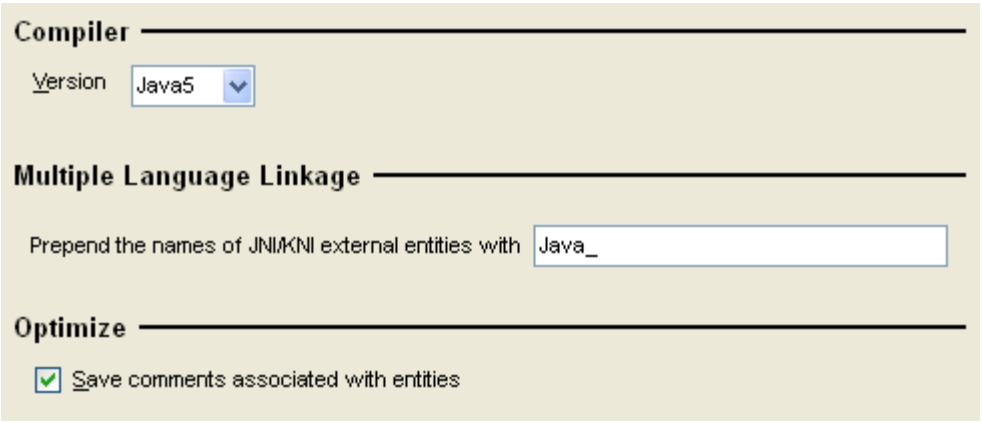
Other Fortran Categories

For information about the **Fortran->Includes->Replacement Text** category, see *C++->Includes-> Replacement Text* on page 3–32.

For information about the **Fortran->Macros** category, see *C++->Macros Category* on page 3–33.

Java Options

In the **Java->Options** category of the Project Configuration dialog, you can specify how to analyze Java source code. You see this window when you choose the **Project->Configure Project** menu item and select the **Java** category.



The **Java->Options** category contains the following fields:

- **Version.** Select the version of Java used by the source code in this project. If you change the version after creating a project, the project will be reanalyzed when you click OK. The choices are Java 1.3, 1.4, and 1.5. For details about the language constructs supported in Java 1.5, see the *Understand 2.0* build log on the Scientific Toolworks website.
- **Prepend the names of JNI/KNI external entities with.** You can specify a prefix used by Java to call functions in other languages. A Java call to a function “func” would match the C function *prepend_pkg_class*_func, where *prepend* is the string you specify here, *pkg* is the Java package name, and *class* is the Java class. This follows the Java Native Interface (JNI) and the Kaffe Native Interface (KNI).
- **Save comments associated with entities.** You can choose whether source code comments that occur before and after an entity should be associated with that entity.

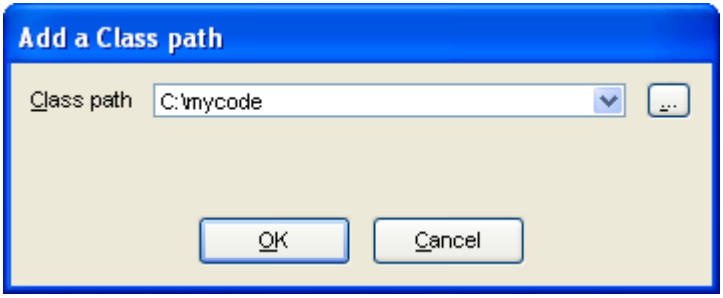
Java->Class Paths Category

The **Java->Class Paths** category allows you to identify Java .jar and .class files that provide classes for which you do not have source code.

Both .jar files and .class files are supported. Jar files contain compressed .java (source) files. Class files contain compiled sources. By default, the src.jar (or src.zip) file provided by the Java Developers Kit is located. You can add other .jar files as needed.

To add a directory with .class and .java files, follow these steps:

1. Click **Add Path**.
2. Locate and select the directory containing .class files.
3. Click **OK**.



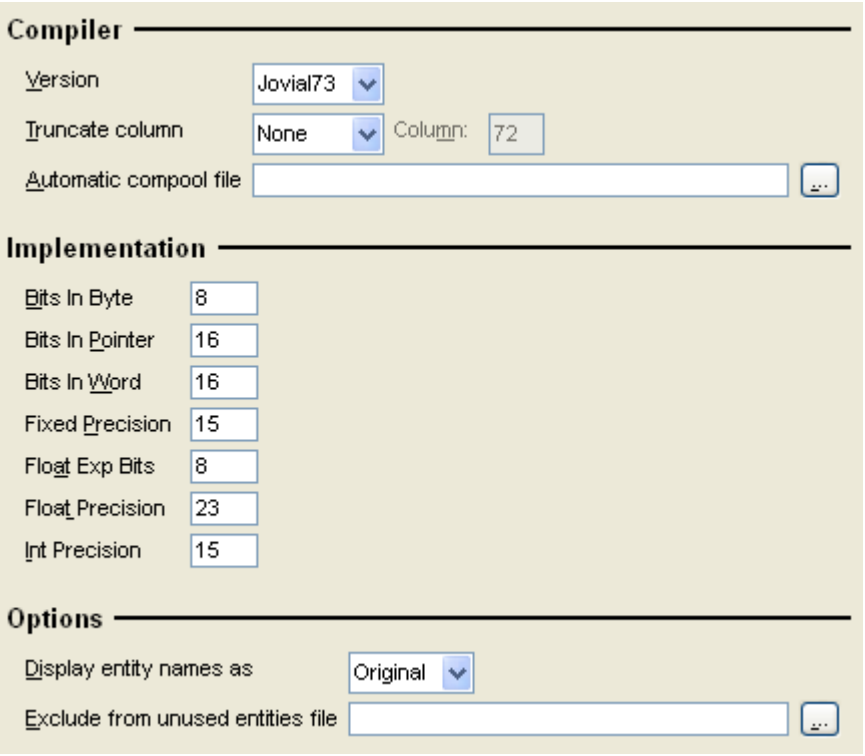
To add a .jar file to the list, follow these steps:

1. Click **New Jar**.
2. Locate and select the .jar or .zip file. You can select multiple .jar files while holding down the Ctrl key.
3. Click **Open**.

If a class is found in both a .java and .class file in the class path, the class in the .java file is used.

JOVIAL Options

In the **JOVIAL->Options** category of the Project Configuration dialog, you can specify how to analyze JOVIAL source code. You see this window when you choose the **Project->Configure Project** menu item and select the **Jovial** category.



The **Jovial->Options** category contains the following fields:

- **Version.** Select the JOVIAL version you use. JOVIAL73 and JOVIAL3 are supported.
- **Truncate column.** By default, statements are not truncated by column location. You may choose to truncate statements at column 72 or at some other user-defined column.
- **Automatic compool file.** Click **...** and browse to the compool file you want to use. The file extension should be .txt.
- **Implementation fields.** The fields in this section allow you to specify the sizes and precision of various datatypes. These sizes vary with different implementations of JOVIAL. You can specify

the number of bits in a byte, number of bits in a pointer, number of bits in a word, precision for fixed datatypes, number of bits in a floating exponent, precision for floating datatypes, and the precision for an integer.

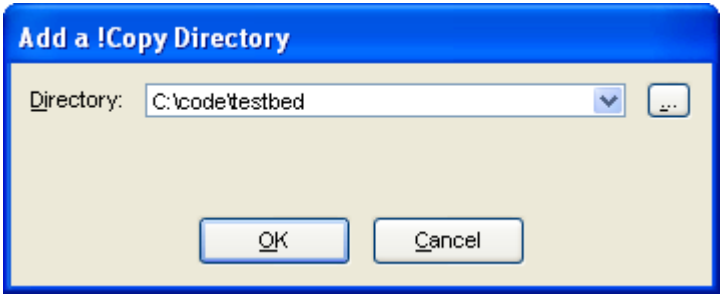
- **Display entity names as.** Choose whether entity names should be displayed in *Understand 2.0* with the same case as the source code (original), all uppercase, all lowercase, only the first letter capitalized, or mixed case.

Jovial->Copy Category

The **Jovial->!Copy** category in the Project Configuration dialog (which you open with **Project->Configure**) lets you select directories to be searched for files named in !COPY directives.

To add a directory to the list, follow these steps:

1 Click the **New**.



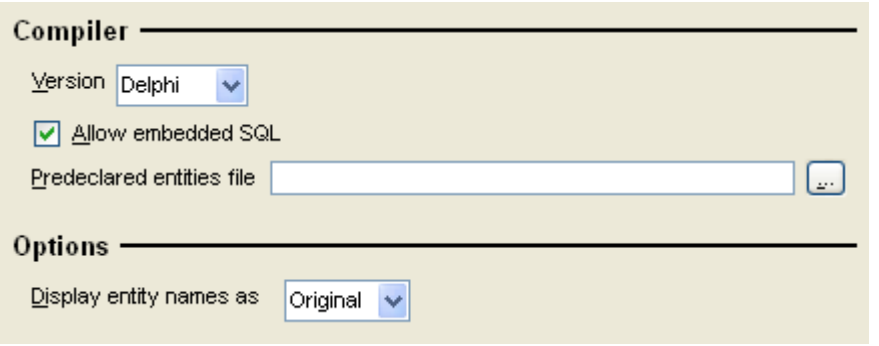
2 Click the **...** button and browse to the directory you want to add.

3 Click **OK**.

When a !COPY directive is analyzed, the directories are searched in the order listed. To change the search order, select a directory and click **Move Up** or **Move Down**.

Pascal Options

In the **Pascal->Options** category of the Project Configuration dialog, you can specify how to analyze Pascal source code. You see this window when you choose the **Project->Configure Project** menu item and select the **Pascal** category.



The **Pascal->Options** category contains the following fields:

- **Version.** Select the version of Pascal used by the source code in this project. The choices are Compaq, Delphi, and Turbo. Select Compaq for legacy DEC Pascal projects.
- **Allow embedded SQL.** Check this box to enable parsing of embedded SQL statements in your source code.
- **Predeclared entities file.** Click **...** to select a text file (*.txt) that contains predeclared routines, types, constants, and parameters used in your source code. Two versions of this file are provided in the <install_directory>/conf/understand/pascal directory: predeclared.txt and predeclareddelphi.txt.

Pascal->Macros Category

The **Pascal->Macros** category allows you to add support for preprocessor macros in source code. For example, the $IF, $IFDEF, and $ELSE directives are supported.

The CPU386 and MSWINDOWS macros are predefined for some types of Pascal/Delphi sources to avoid generating syntax errors with the standard library.

For more information about the **Pascal->Macros** category, see *C++->Macros Category* on page 3–33.

Pascal->Namespaces Category

The **Pascal->Namespaces** category allows you to add a directory of namespaces to use when locating a unit specified in a USES statement. A USES statement may refer to a unit without specifying a namespace. So, directories you add in this category are searched in the order provided to find units with unspecified namespaces.

For example, in the following statement, Unit1 has a namespace specified, so only the namespace CompanyName.ProjectName is searched for Unit1. Since Unit2 has no namespace specified, the namespaces in the Namespaces category will be searched for Unit2.

```
uses CompanyName.ProjectName.Unit1, Unit2;
```

To add a namespace directory, follow these steps:

1. Click the **New** button.
2. Click the **...** button and browse to a directory. Then click **OK**.
3. You can click **Move Up** or **Move Down** to change the precedence order in which the standard libraries are checked.

Pascal->Standard Library Paths Category

The **Pascal->Standard Library Paths** category allows you to specify directories that should be searched for standard libraries.

Standard library paths are used to find units that are not found in the project files. Only files that contain the required units are processed. For example the following statement causes the standard libraries to be searched for a unit names System:

```
Uses System;
```

The standard libraries are not used when computing project metrics.

To add a directory, follow these steps:

1. Click the **New** button.
2. Click the **...** button and browse to a directory. Then click **OK**.
3. You can click **Move Up** or **Move Down** to change the precedence order in which the standard libraries are checked.

Pascal->Search Paths Category

The **Pascal->Search Paths** category allows you to specify directories to search. To add a directory, follow these steps:

1. Click the **New** button.
2. Click the **...** button and browse to a directory. Then click **OK**.
3. You can click **Move Up** or **Move Down** to change the precedence order in which the standard libraries are checked.

PL/M Options

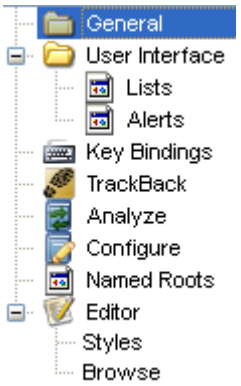
In the **PL/M->Options** category of the Project Configuration dialog, you can specify how to analyze PL/M source code. You see this window when you choose the **Project->Configure Project** menu item and select the **PL/M** category.

The **PL/M->Options** category contains the following fields:

- **Display entity names as.** Choose whether entity names should be displayed in *Understand 2.0* with the same case as the source code (original), all uppercase, all lowercase, only the first letter capitalized, or mixed case.

Setting General Preferences

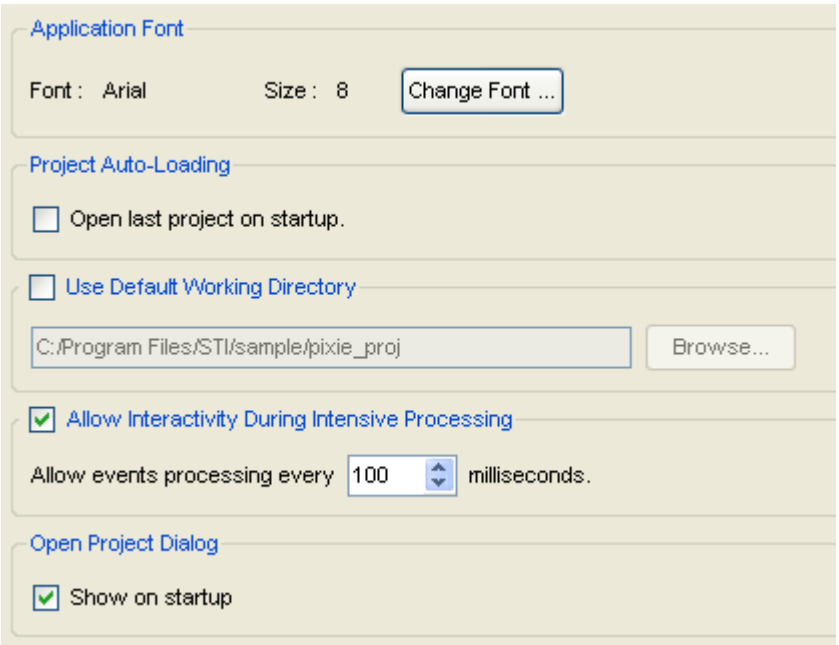
Understand 2.0 allows you to control a number of aspects of its operation using the Software Options dialog. To open this dialog, choose **Tools-> Options**. This dialog provides options to set in the categories shown to the left:



The subsections that follow describe each of the categories.

General Category

The following options can be controlled from the **General** category of the **Tools->Options** dialog:

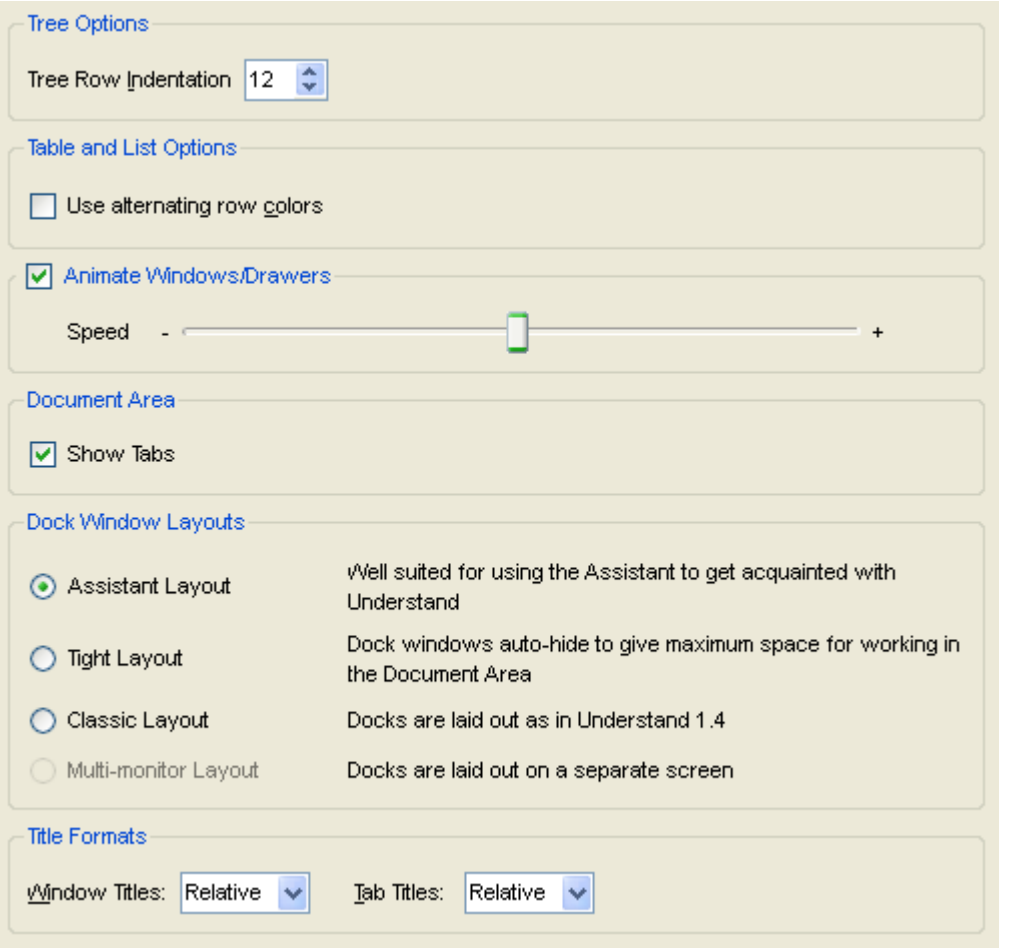


- **Application Font.** To change the font used in dialogs and lists in *Understand 2.0*, click **Change Font** and select the font, font style, and font size you want to use and click **OK**.

- **Open last project on startup.** If checked (off by default), the most recently opened project is automatically opened when you start *Understand 2.0* with no other project specified. This is a useful option if you typically work with only one project.
- **Use default working directory.** If checked (off by default), you can select an alternate default directory. This will be the starting place when you are browsing for other directories. The default is the directory where your project is saved.
- **Allow interactivity during intensive processing.** If checked (on by default), you can interact with *Understand 2.0* while it is performing background processing. Your interactive events are processed at the interval you specify in milliseconds.
- **Open project dialog, Show on startup.** If checked (on by default), the Create/Open Project dialog (see page 2–5) is shown when you start *Understand 2.0*.

User Interface Category

The following options can be set from the **User Interface** category of the **Tools->Options** dialog:

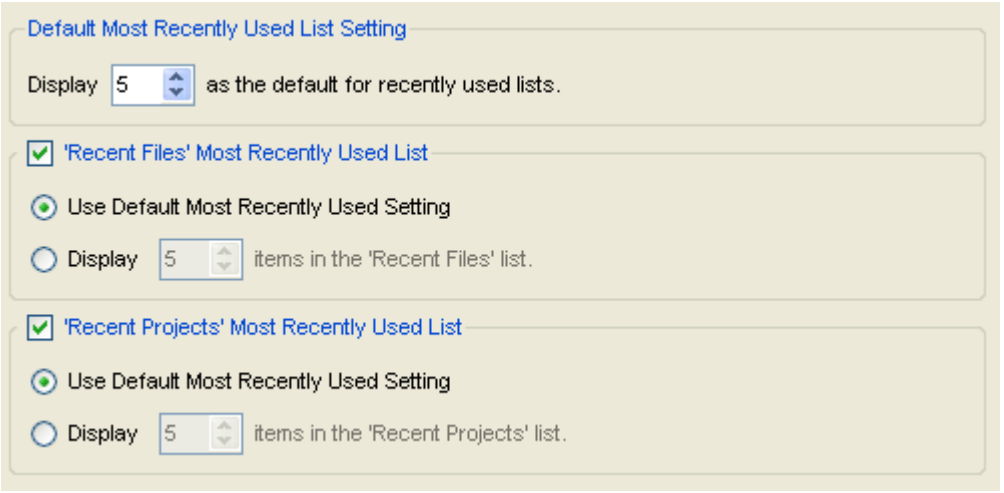


- **Tree row indentation.** You can change the amount of indentation in hierarchical tree displays.
- **Use alternating row colors.** If checked (off by default), lists and tables have shading for alternate rows.
- **Animate windows/drawers.** If checked (on by default), opening and closing windows and tabbed areas (drawers) is animated. You can choose a faster or slower speed than the default.

- **Show tabs.** If checked (the default), tabs are shown at the top of the document area for each of the windows open in that area. This included the Project Assistant, source editor windows, graphical views, and other windows.
- **Dock Window Layouts.** Choose which window layout you would like to use as the default. The **Assistant Layout** is good for new users. The **Tight Layout** is useful if you will be opening several source files and want plenty of screen space for that. The **Classic Layout** is similar to earlier versions. The **Multi-monitor Layout** allows you to take advantage of multiple screens if you have them.
- **Title Formats.** Choose whether you want filenames in window and tab names to be short names, long (full path) name, or relative to the project database.

User Interface->Lists Category

The following options can be set from the **User Interface->Lists** category of the **Tools->Options** dialog:


Default Most Recently Used List Setting
Display 5 as the default for recently used lists.
'Recent Files' Most Recently Used List
Use Default Most Recently Used Setting
Display 5 items in the 'Recent Files' list.
'Recent Projects' Most Recently Used List
Use Default Most Recently Used Setting
Display 5 items in the 'Recent Projects' list.

- **Default most recently used list setting.** The default is to show five items in a list of recently used items. You can change that default for both lists here.
- **Recent files most recently use list.** To change the number of recently used files in the **File** menu, select the **Display** item and change the number to display. If you want to omit the recently used files from the **File** menu, uncheck this box.

- **Recent projects most recently use list.** To change the number of recently used projects in the **File** menu, select the **Display** item and change the number to display. If you want to omit the recently used projects from the **File** menu, uncheck this box.

User Interface-> Alerts Category

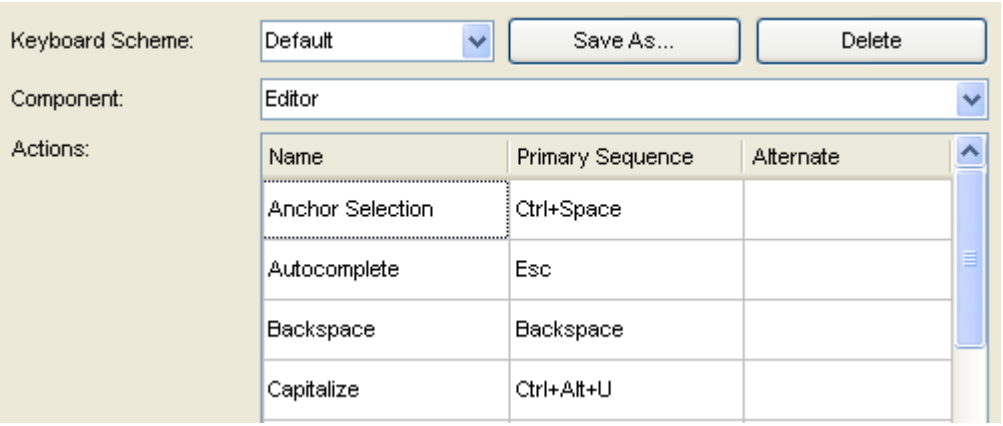
The following options can be set from the **User Interface->Alerts** category of the **Tools->Options** dialog:

Save On Parse
Always Prompt
Save modified files before parsing
Don't save modified files before parsing
Save On Command
Always Prompt
Save modified files before running a command
Don't save modified files before running a command
Project Open
Prompt before closing the current project

- **Save on parse.** Choose what you want done with changed but unsaved source files when the database is to be analyzed. The default is to always prompt you to choose whether to save files. Alternately, you can choose to automatically save changed files or to not save changed files.
- **Save on command.** Choose what you want done with changed but unsaved source files when a command is to be run. The default is to always prompt you to choose whether to save files. Alternately, you can choose to automatically save changed files or to not save changed files.
- **Prompt before closing the current project.** If checked (the default), you are asked whether you want to close the current project and all associated windows when you attempt to open a different project.

Key Bindings Category

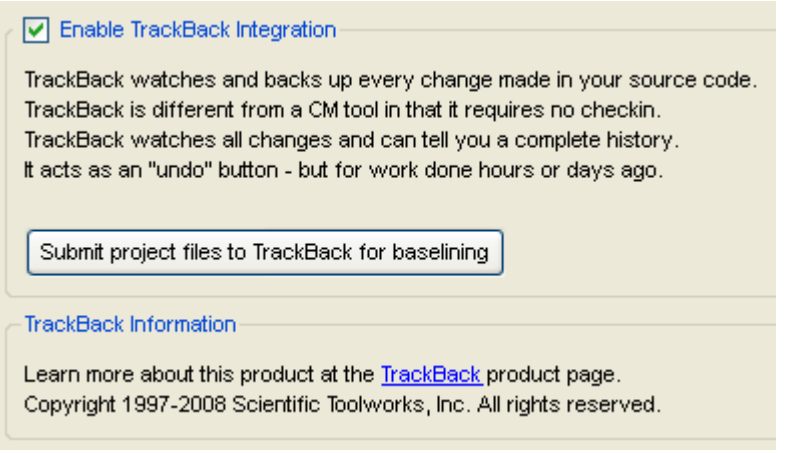
The functions of keys in *Understand 2.0* can be customized. The **Key Bindings** category of the **Tools->Options** dialog lets you choose how keys will work in *Understand 2.0*:



- **Keyboard Scheme.** This field will allow you to choose keyboard settings that are similar to other applications. This field is not yet implemented.
- **Component.** You can choose a portion of *Understand 2.0* for which you want to modify the key behaviors. The components are Application (dialogs and items not otherwise listed), Editor, Favorites, Find Results, Info Browser, and Project Browser.
- **Actions.** In the list of actions, you can modify the key sequences by placing your cursor in the **Primary Sequence** or **Alternate** column for an action. Then press the key combination you want to perform that action. If the key combination is already used, you will see a warning message. Note that you can't use normal editing keys like Backspace or Delete to edit the keys shown in these fields. Use the **Restore Defaults** or **Cancel** button if you make changes you don't want to save.

TrackBack Category

The **TrackBack** category of the **Tools->Options** dialog allows you to send files to the separate *TrackBack* software to be watched for changes.

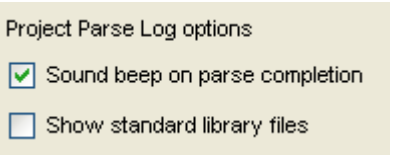

Enable TrackBack Integration
TrackBack watches and backs up every change made in your source code.
TrackBack is different from a CM tool in that it requires no checkin.
TrackBack watches all changes and can tell you a complete history.
It acts as an "undo" button - but for work done hours or days ago.
Submit project files to TrackBack for baselining
TrackBack Information
Learn more about this product at the TrackBack product page.
Copyright 1997-2008 Scientific Toolworks, Inc. All rights reserved.

By default, *TrackBack* is installed with *Understand 2.0* and integration is enabled. To have all of the files in this *Understand 2.0* project watched for changes, click the **Submit** button.

For more about *TrackBack* integration, see page 8–23.

Analyze Category

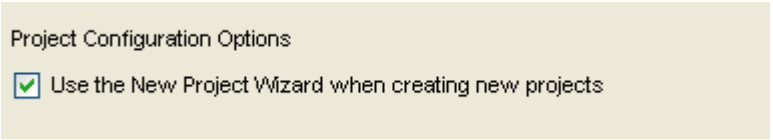
The **Analyze** category of the **Tools->Options** dialog allows you to specify options for how the project is analyzed.



- **Sound beep on parse completion.** By default, a beep notifies you when the analysis is complete.
- **Show standard library files.** For languages whose standard libraries are parsed by *Understand 2.0* (such as Ada), if you check this box the standard library files are shown in the parse log. By default this box is not checked, and the parse log is shorter.

Configure Category

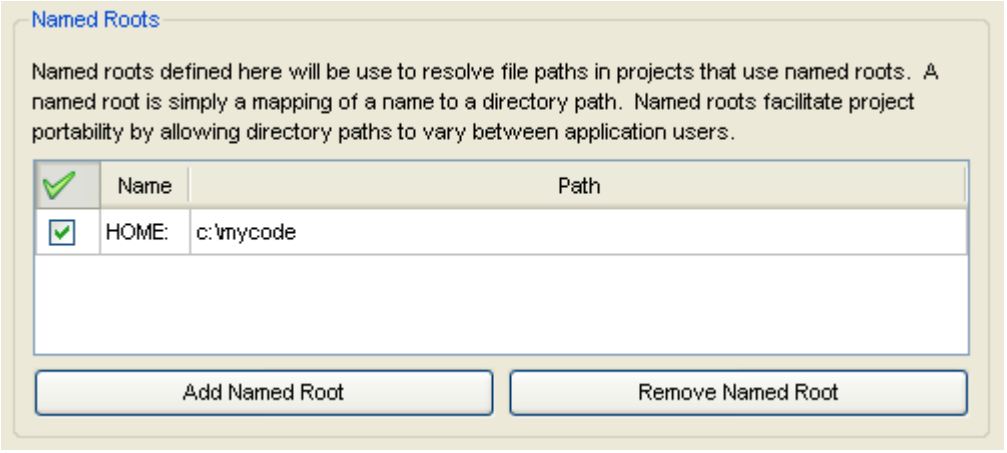
The following options can be set from the **Configure** category of the **Tools->Options** dialog:



- **Use the New Project Wizard when creating new projects.** The check in this box causes the New Project Wizard (page 3–3) to be used when you choose **File->New Project**. If you uncheck this box, you can specify a project database location and filename and then use the full Project Configuration dialog.

Named Roots Category

The Named Roots category of the **Tools->Options** dialog lets you specify names used as substitutes for file paths.


Named Roots
Named roots defined here will be use to resolve file paths in projects that use named roots. A named root is simply a mapping of a name to a directory path. Named roots facilitate project portability by allowing directory paths to vary between application users.
Name
Path
HOME:
c:\mycode
Add Named Root
Remove Named Root

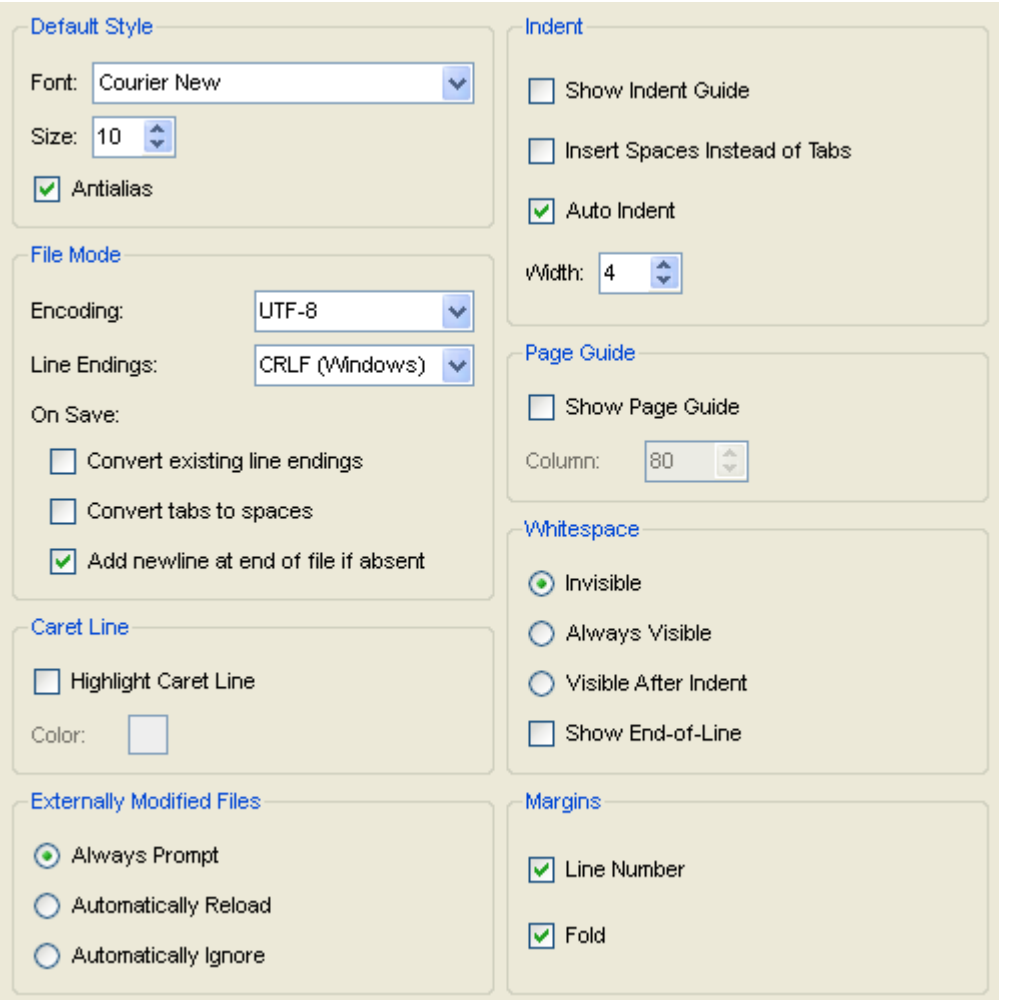
After you have defined a named root, you can use that name in other *Understand 2.0* dialogs, such as the Project Configuration. This is useful, for example, if you want to share projects with people who reference project files over a network using different paths.

To add a named root, click the **Add Named Root** button. This adds a new row where you can type a name and a path (or click the folder icon to browse for the location).

You can uncheck named roots if you want to temporarily deactivate certain names.

Editor Category

The following options can be set from the **Editor** category of the **Tools->Options** dialog:



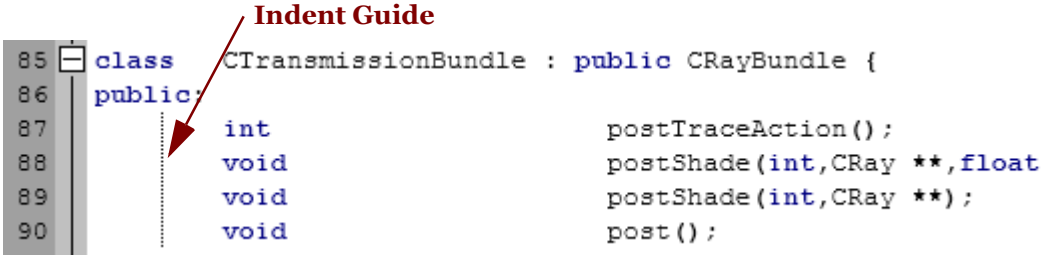
- **Default style.** Use the **Font** pull-down list to select a font for Source Editor windows. The fonts shown are the fixed-width fonts available on your system. Select a **Size** for the Source Editor text. If you check the **Antialias** box, the font is smoothed.
- **File Mode.** Select the type of **Encoding** to use when saving source files and the **Line Endings** character you want used. Many encoding formats are supported. You should change this only if your other applications have problems opening or displaying files created by *Understand 2.0*. By default, these settings apply only to new files you create, including text and

CSV files. The previous format is preserved for existing files. However, if you check the **Convert existing line endings** box, files you save are converted to the format chosen here.

- **Windows** line-endings are terminated with a combination of a carriage return (\r) and a newline (\n), also called CR/LF.
- **UNIX** line-endings are terminated with a newline (\n), also referred to as a linefeed (LF).
- **Classic Macintosh** line-endings are terminated with a single carriage return (CR).

If you check the **Convert tabs to spaces** box, tabs are changed to the number of spaces specified in the **Width** field when you save the file. Also, if you check the **Add newline at end of file if absent** box, a new line character is added to a file that doesn't have one when you save the file (checked by default).

- **Caret Line.** Check the **Highlight Caret Line** box if you want the full line on which your cursor is located to be highlighted. The default **Color** is light gray, but you can change that by clicking the color box and using the Select Color dialog.
- **Externally Modified Files.** If an open file is changed in some other program, *Understand 2.0* detects this. Choose **Always Prompt** if you want to be notified and asked to load that changed version. **Automatically Reload** does this without prompting. **Automatically Ignore** is dangerous and not recommended.
- **Indent.** Check the **Show Indent Guide** box if you want a dotted line to show where lines should be indented to. By default, the **Insert Spaces Instead of Tabs** box is off; turning it on adds spaces to a source file when you press Tab. Checking the **Auto Indent** box causes automatic indentation when you are typing in the Source Editor. For **Width**, specify the number of blank spaces to use when showing tabs.



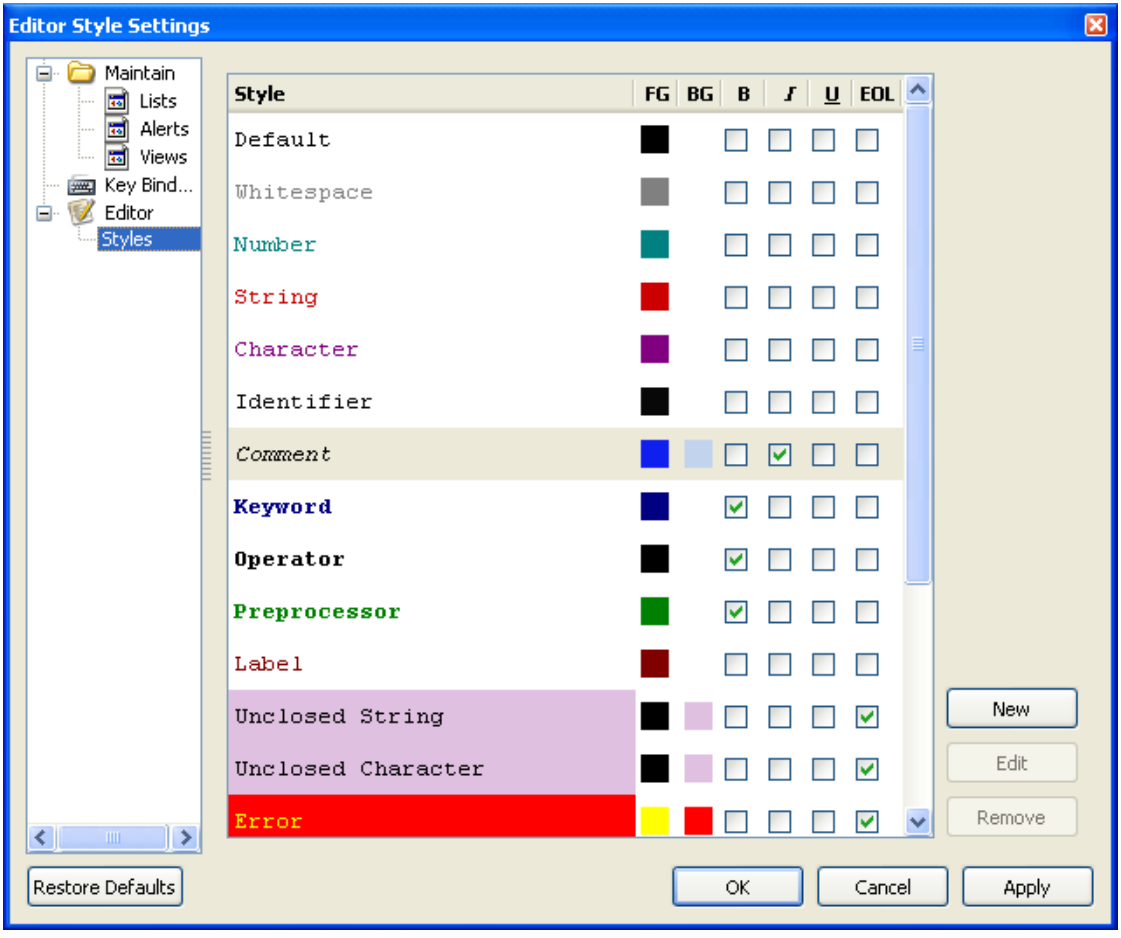
- **Show Page Guide.** Check the **Page Guide** box to display a line similar to the Indent Guide at a defined line width. Set the **Column** to the character width you want to see indicated.

- **Whitespace.** Select whether you want to see indicators about whitespace characters. A dot indicates a space, and an arrow indicates a tab. You can choose Invisible (the default), Always Visible, or Visible after Indent. Check the **Show End-of-Line** box to see the characters that force a line break.
- **Margins.** Check **Line Number** (on by default) to turn on line numbering in the source view. Check **Fold** (on by default) to turn on the ability to “fold” source code entity blocks out of the way.

Editor->Styles Category

You can customize the colors used in the Source Code Editor in the Options dialog. To open this dialog, choose **Tools->Options**. Expand the **Editor** category, and select the **Styles** category.

To change a color, click a color square next to an item in the list. Use the Select Color dialog to choose a new color for that item.



You can change the text foreground (FG) and background (BG) colors for any item. You can also make the text bold (B), italic (I), or underlined (U) for any item. To highlight the whole line for an item, check the EOL box.

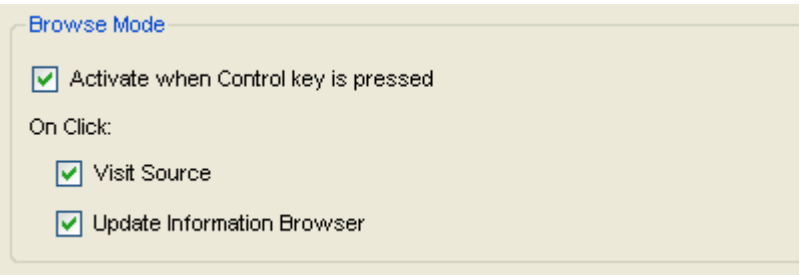
By default, the following color codes are used for the source code:

- **Dark blue text:** used for language keywords
- **Red text:** used for characters and character strings
- **Italic blue text:** used for comments
- **Green text:** used for preprocessor statements
- **Black text:** used for all other source text and for line numbers
- **White background:** used for most source text
- **Pink background:** used for inactive lines of code
- **Gray background:** used for line numbers
- **Yellow background:** used to highlight text in Find Results for Find in Files.

Additional items are available for customization depending on your source code language. For Delphi, you can customize the colors of module, routine, and type names. For FORTRAN, you can customize the colors of block, module, subprogram, and type names. For Ada, you can customize the colors of package names, subprogram names, and type names.

Editor->Browse Category

You can control the behavior of Browse Mode (see page 6–4) in the Source Editor. To see this dialog, choose **Tools->Options**. Expand the **Editor** category, and select the **Browse** category.



- **Activate when Control key is pressed.** If this box is checked (on by default), Source Editor windows use Browse Mode if you are holding down the Ctrl key when pointing at an entity.

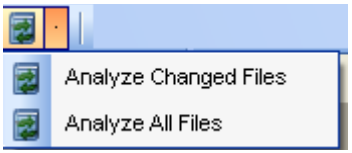
- **Visit Source.** If this box is checked (on by default), clicking an entity while in Browse Mode causes focus to jump to the declaration of that entity.
- **Update Information Browser.** If this box is checked (on by default), clicking an entity while in Browse Mode causes the Info Browser to show information about an entity when you click on it.

Analyzing the Code

Once you have configured a project, *Understand 2.0* can parse (that is, analyze) the project. During analysis, the source files are examined and data is stored in the *Understand 2.0* database. After parsing, the *Understand 2.0* database contains lots of data to browse.

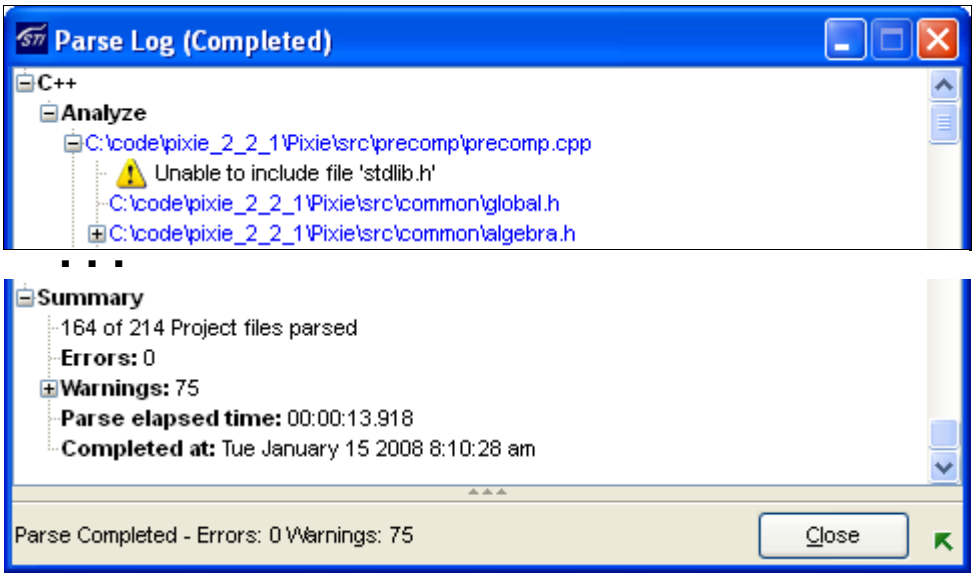
When you save or modify the project configuration, a prompt to analyze the project appears automatically. You can also analyze the project in the following ways:

Project->Analyze Changed Files. This analyzes all files that have been changed and all files that depend on those changed since the last analysis. This is also referred to as "incremental analysis." To analyze changed files, you can also left-click the toolbar icon shown here.



Project->Analyze All Files. This forces a full analysis of all project files, whether they have changed since the last analysis or not. As a shortcut for this command, you can right-click on the icon and choose **Analyze All Files**.

For either command, the status is reported on the Status Line and the *Command Results* window appears with a log of the results.



Analyzing a large project can take some time. If you click **Cancel** while the project is being analyzed you will see a message that says this action will leave the project in an incomplete state. You will need to analyze the project in order to explore it.

When the analysis is complete, the source code for any errors or warnings may be examined by double-clicking on the message in the *Parse Log* window.

To save the Parse Log to a text file, right-click on the white background of the Parse Log and choose **Save As**. Specify the location and name of the file you want to save.

Tip: A configured project may be analyzed in batch mode using the command line program *"und"*. Refer to *Using the und Command Line* on page 12–2 for details on using *"und"*.

See *Analyze Category* on page 3–52 for options that affect the project analysis.

Chapter 4 Exploring Your Codebase

This chapter covers the basic windows in *Understand 2.0* and their options in detail. It also covers operations within the Filter Area and the Info Browser.

Details on the use and operation of the Entity Locator and Find in Files for searching for and locating entities are provided in the chapter *Searching Your Source* on page 5–1.

Details on the use and operation of the **Source Editor** is contained in the chapter *Editing Your Source* on page 6–1.

This chapter contains the following sections:

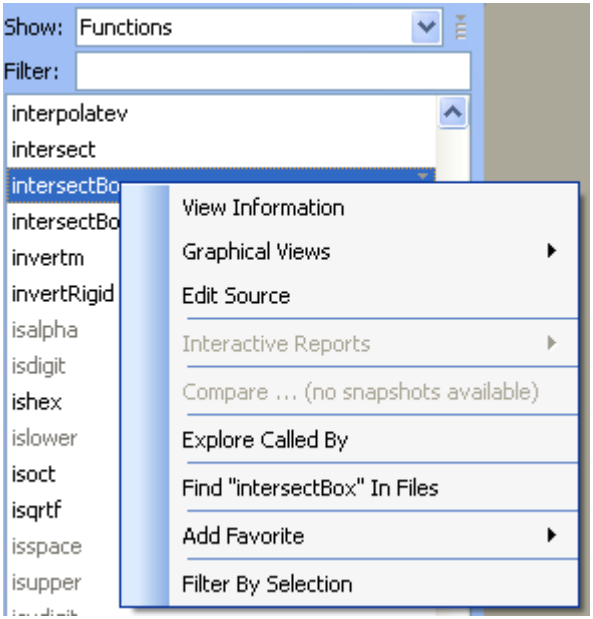
Section	Page
PLEASE RIGHT CLICK	4–2
Various Windows Explained...	4–3
Project Assistant	4–4
Entity Filter	4–5
Info Browser	4–8
Project Browser	4–13
Project Metrics Browser	4–15
Exploring a Hierarchy	4–16
Favorites	4–17

PLEASE RIGHT CLICK

Sorry for shouting (by using all caps above). In order to make the *Understand 2.0* interface as quick, tight and elegant as possible, we have hidden a lot of power beneath your mouse buttons.

The general rule is that Anywhere you look you can right-click to do or learn something. A second general rule is that right-click reuses windows where it can and **Ctrl + right-click brings up new windows.**

So please right-click. There will be no more reminders.



Check out all the stuff you can learn or do right-clicking!

Right-click almost anywhere to bring up a menu.

Ctrl + right-click brings up the same me but actions happen in a new window.

Various Windows Explained...

Understand 2.0's GUI has a number of tools for locating and examining entities. This chapter provides a brief list of all these tools and describes the Entity Filter, Info Browser, and Favorites in more detail.

The tools available for finding and exploring entities are:

- **Project Assistant.** Provides links to actions you can perform. See page 4–4.
- **Entity Filter.** Provides an alphabetic list of entities of the selected type. See page 4–5.
- **Info Browser.** Provides an explorer for entity characteristics and connections. See page 4–8.
- **Project Browser.** Lets you browse a hierarchical file list. See page 4–13.
- **Exploring View.** Lets you browse a relationship hierarchy. See page 4–16.
- **Favorites.** Lets you provide quick links to frequently-used entities. See page 4–17.
- **Entity Locator.** Lets you filter all entities in a project in complex ways. See page 5–3.
- **Find in Files.** Searches multiple files. See page 5–8.
- **Source Editor.** Shows source code. See page 6–1.
- **Scope list.** Lists the functions or similar constructs in a file. See page 6–3.
- **Architectures.** Defines named regions and views of the project. See Chapter 7.
- **Snapshots.** Explore the history of an entity. See Chapter 8.
- **Graphical Views.** Shows connections and structures of entities. See Chapter 9.
- **Reports.** Generate reports about entities. See Chapter 10.
- **Metrics.** Generate statistics about entities. See page 10–22.

Project Assistant

The *Project Assistant* provides links to useful tools. If you close the Project Assistant, you can reopen it by choosing **Project->Project Assistant**.

The **Project Information** portion of the Project Assistant tells you the full path to the project database, the languages supported in this project, the number of files in the project, and the total lines of code in the project.

The remaining sections of the Project Assistant provide links to various tools. For information about these tools, see the following locations:

Explore

- **View Project Files.** See page 4–5.
- **View Project Functions.** See page 4–5.
- **Search Project Files.** See page 5–8.
- **Search Project Entities.** See page 5–3.

Architect

- **What is an Architecture?** See page 7–2.
- **Create a Custom Architecture.** See page 7–10.
- **Browse Architectures.** See page 7–3.
- **Manage Architectures.** See page 7–9.
- **Predefined Architectures.** See page 7–10.

Snapshots

- **What is a Snapshot?** See page 8–2.
- **Manage Snapshots.** See page 8–2.
- **Compare Snapshots.** See page 8–6.

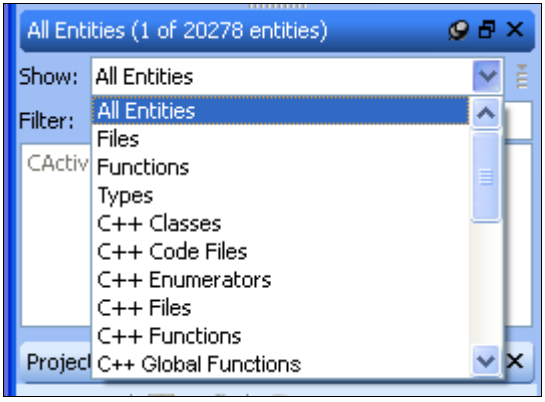
Project Metrics

- **Project Metrics Browser.** See page 4–15.
- **Generate Project Metrics.** See page 10–22.
- **Generate Project Reports.** See page 10–2.

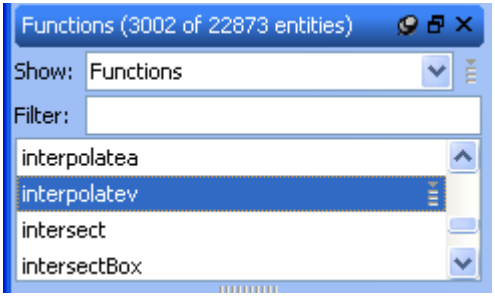
Entity Filter

The *Entity Filter* provides a quick list of the selected entity type. You can filter this list to match a text string.

The options in the **Show** list depend upon the languages you have enabled for your project and the types of entities and relationships found in your project. If your project uses multiple languages, the language is listed along with the type.



For each of these types, you can quickly find any entity that has been declared (or used) in the source code.



By default, the entities are sorted in ascending (A to Z) order. You can reverse the order by clicking the drop-down icon and choosing **Sort Descending**.

You can only have one Entity Filter open. If you close the Entity Filters window, reopen it by choosing **Search->Entity Filter**.

Using the Filter Field

In the **Filter** field, you can type a string to match a set of entities. By default, the string matches entity names starting from the first character. So, for example, you can type “y” to list only entities that contain a Y or y anywhere in the name.

If you want to quickly jump to the point in the list where entities begin with a particular letter, just click in the list of entities and type a letter.

You can select other ways for the **Filter** field to work. Click the drop-down icon and choose **Filter Pattern Syntax**. The options are:

- **Fixed String.** This is the default behavior.
- **WildCard.** With this option selected, you can use * (any characters) and ? (any single character) wildcards for pattern matching. See page 5–5 for examples.
- **Regular Expression.** With this option selected, you can use UNIX-style regular expressions. See page 5–5 for an overview.

By default, filtering is case-insensitive. You can make it case sensitive by clicking the drop-down icon and choosing **Filter Case Sensitivity->Case Sensitive**.

When you are finished using a filter and want to see all the entities for the selected type, click the drop-down icon and choose **Clear Filter**.

Customizing the Display

You can modify how the Entity Filter lists entities as follows:

By default, the full entity name is shown in the Entity Filters list and entities are alphabetized by their full name. This name may include a class prefix or other language-specific prefix type. To list entities by their “short”, unprefixed names, click the drop-down icon and choose **Entity Name as->Short Name.**

By default, only the name of the file is shown in a Files list in the Entity Filter. This name does not include the file location. To list files including their locations, click the drop-down icon and choose **File Name as->Relative Name** or **File Name as->Long Name**.

Root Filters

Notice that there are the filter type names that contain “Root”, as in **Root Calls, Root Callbys**, and **Root IncludeBys**. These “Root” types show only the top of a given tree. The tops (or bottoms) of relationship trees are often helpful points to begin exploring code that is new to you.

- **Root Calls -** lists only entities that call others, but are not called themselves. These are either high-level code (mains), code called by hardware (interrupt handlers), or dead (unused) code.
- **Root CallBys** - lists only entities that are called by others, but that do not call anybody else. These are low-level routines.
- **Root IncludeBys** - lists only files included by others, but not included themselves. These are “lower” level include files.
- **Root Classes** - lists only classes not derived from other classes. These are candidates for lower level classes, or library classes.
- **Root Decls -** lists only the highest level declaring routines. (Ada)
- **Root Withs** - lists only program units (packages, tasks, subprograms) that With other program units, but are not withed by anybody else. (Ada)

Info Browser

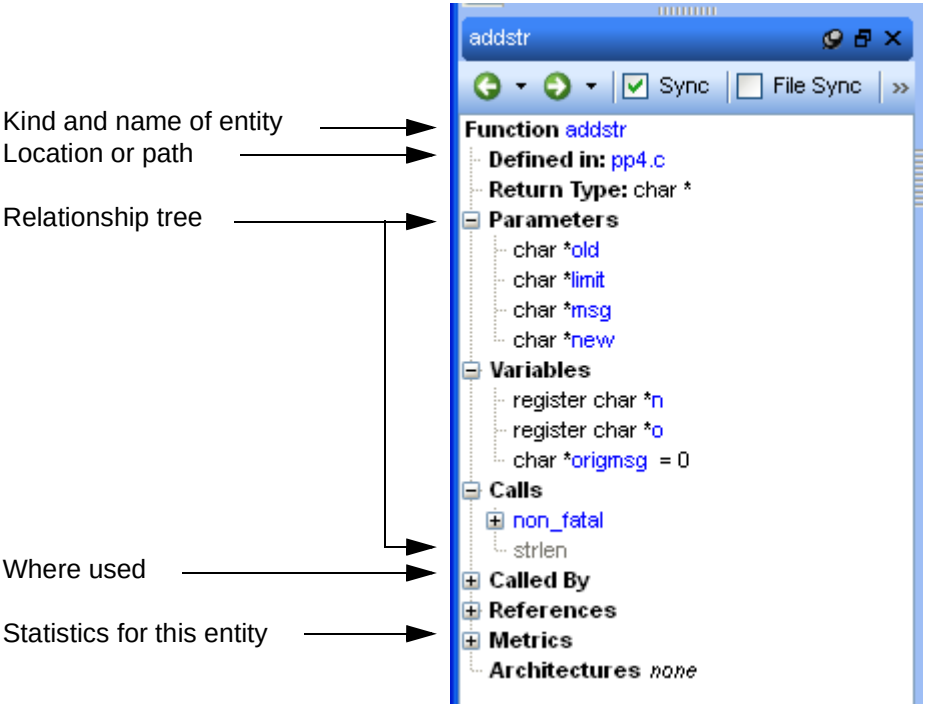
When you click on an item in the *Entity Filter* or in a number of other windows, the *Info Browser* updates to show everything that *Understand 2.0* knows about that entity. The *Info Browser* shows this data as a tree whose branches can be expanded individually or all at once.

If the Info Browser isn't open, you can open it by either clicking on an item in the Entity Filter or Project Browser. Or, you can right-click on an item anywhere and choose **View Information**.

Everything *Understand 2.0* knows about an entity can be learned using the *Info Browser*. The information is shown in a tree. The tree can be expanded selectively or in bulk. Each terminating item (leaf) of a tree provides some information about that entity.

All information in an *Info Browser* window can be saved to a text file, or copied and pasted via standard Windows or X11 copying functions.

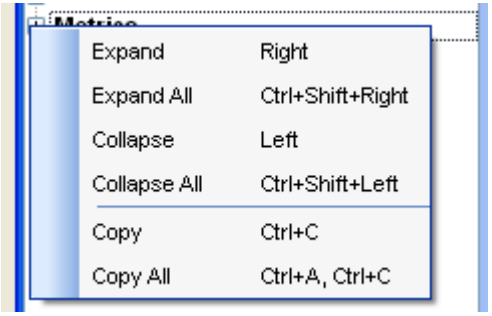
As you drill down you can change which entity you are learning about. Each time you change the entity, it is remembered in the Info Browser history for quick backtracking.



Drilling Down A Relationship

Drilling down the tree works as expected (mostly). To expand a tree, click on the + sign. To close the tree click on the - sign.

Right-clicking brings up a menu that includes expand/collapse options. **Expand All** provides a shortcut to expand all levels of the selected branch.



To open or close the entire tree, right-click on the top item and choose **Expand All** or **Collapse All**.

See *Saving and Printing Info Browser Text* on page 4–11 for details on the other options in this right-click menu.

Displaying More or Less Information

If you right-click on a bold heading such as **Calls**, **Called By** or **References** in the Info Browser, you'll see options in the right-click menu that let you modify how that entity is listed. These options include:

- **Fullname.** If checked, the fully-qualified name of the entity is shown.
- **Parameter.** Lists the parameters.
- **Reference.** Choose "Full" to include the file and line location of the reference.
- **Return Type.** Lists the return type.
- **Sort**. Controls the sort order of the list.
- **Type.** If checked, the datatype is shown.
- **Filename.** Controls whether the reference format is short, long, or relative to the project database.

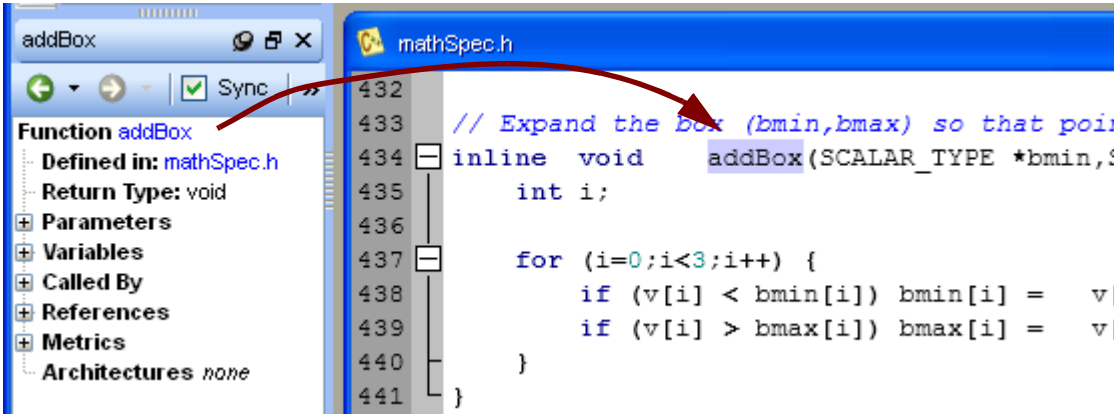
Syncing the Info Browser

You can have multiple Info Browser windows open if you uncheck the **Sync** box. Selecting an entity or choosing **View Information** updates the Info Browser that has its **Sync** box checked.

The **File Sync** box synchronizes the Info Browser with the file in the active Source Editor.

Visiting Source Code

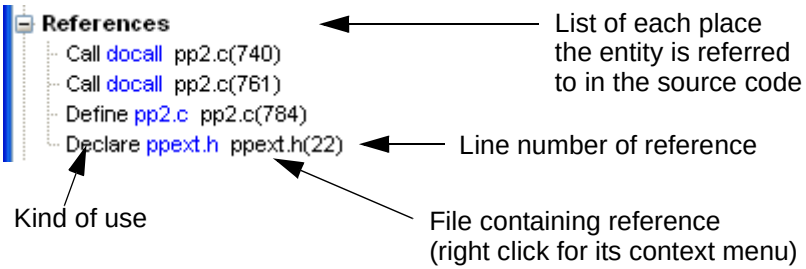
In general, if you double-click on an entity in an informational window (*Info Browser* or *Entity Filter*) the declaration of that entity will be loaded into the *Document Area*.



Another way to visit source from any entity you see in *Understand 2.0*, is the right-click menu. Where appropriate, an entity's right-click menu contains an **Edit Source** menu item. In some cases there are separate menus items for **Edit Definition** and **Edit Declaration** or separate menus for other language-specific locations.

Visiting References

The portion of the *Info Browser* labeled "References" lists everywhere the entity is referred to in the analyzed source code:


References
Call docall pp2.c(740)
Call docall pp2.c(761)
Define pp2.c pp2.c(784)
Declare ppext.h ppext.h(22)
List of each place the entity is referred to in the source code
Line number of reference
Kind of use
File containing reference (right click for its context menu)

Left-click on any reference to visit that location in the source code.

Viewing Metrics

The last node on the Info Browser tree is **Metrics**. This branch shows the metrics available for the current entity.

If you are changing the entity frequently in a large project, closing this node until you want to view the metrics may improve the speed of Info Browser updates.

See *Metrics Reports* on page 10–22 for details on metrics.

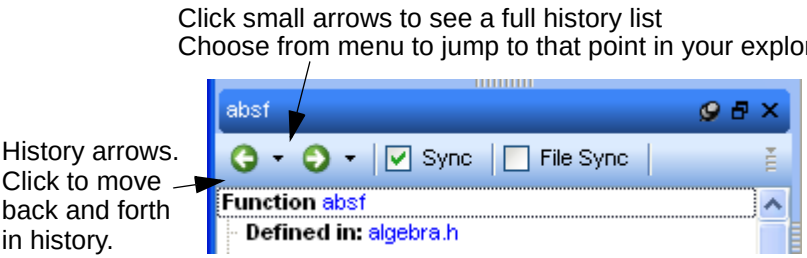
Saving and Printing Info Browser Text

All text shown in the *Info Browser* can be copied to the clipboard for pasting into another application as unformatted text. Only the currently expanded branches are pasted. When saving or pasting in text format, the branches of the tree are represented by indents in the text.

The right-click menu offers choices to **Copy** (only the selected line) and **Copy All**.

Entity History

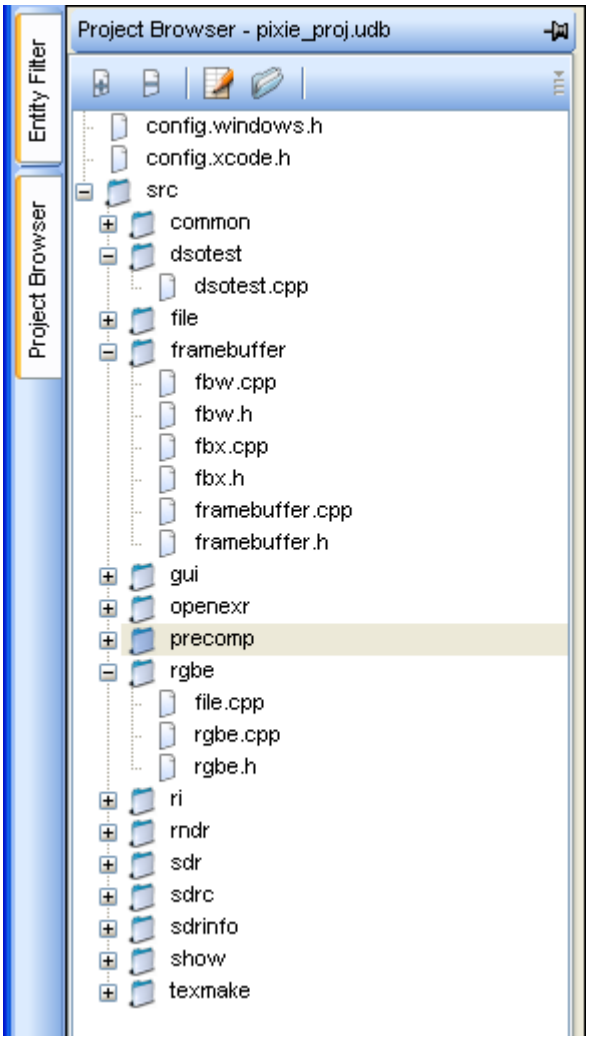
As you explore your code, you can go a lot of places quickly. Often you want to backtrack to explore a new path. To help you do this, the *Info Browser* contains a full history of what is has displayed. The *Info Browser* history can be found in the bottom left corner:


Click small arrows to see a full history list
Choose from menu to jump to that point in your exploration.
History arrows. Click to move back and forth in history.
absf
Sync
File Sync
Function absf
Defined in: algebra.h

Use the right and left arrows to move back and forward in the history list. The down-arrows show the whole list.

Project Browser

To open the Project Browser, choose **Project->Project Browser** from the menus.

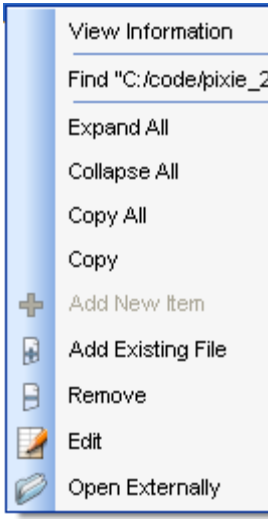


By default, the Project Browser is in the same area as the Entity Filter (and the Architecture Browser). Use the tabs on the left to switch between browser tools in this area.

The Project Browser shows the project files in their directory hierarchy. You can expand and collapse the tree as needed.

The right-click menus for this view offer a number of options. The options with icons are also available in the toolbar for this browser.

Show in Info Browser
Use with Find in Files
Open tree all the way
Close tree all the way
Copy full text to clipboard
Copy selected item text to clipboard
Add new item to project
Add a file to the project
Remove selected item from project
Open item in Source Editor
Open item with operating system tool

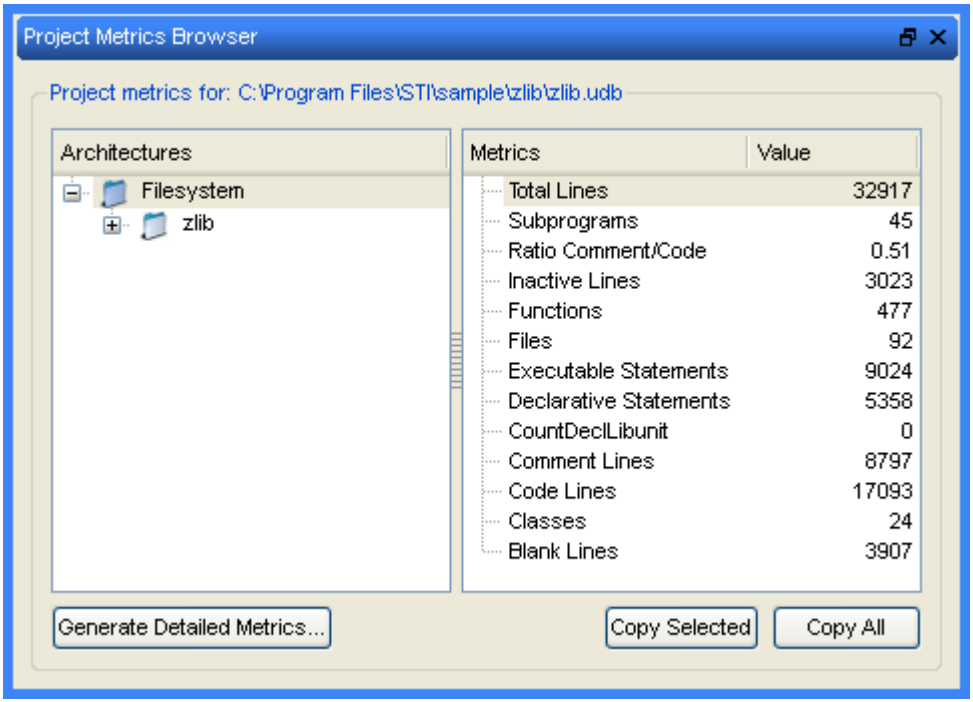


The **Open Externally** command opens an operating system dependent tool for the directory or file. For example, on Windows it opens a directory using the Windows Explorer. For a file it opens the default tool for the file extension.

For a file, the right-click menu includes additional commands, including commands to open graphical views, to parse (analyze) this file only, to compare snapshots of this file, to find uses of the filename in project files, and to add the file to the Favorites list.

Project Metrics Browser

To open the Project Browser, choose **Project->Browse Project Metrics** from the menus or click **Project Metrics Browser** in the Project Assistant.



In this tool, you can browse the enabled architectures in your project and select any architecture node or file in the project. The list on the right shows basic code size metrics for the selected directory or file.

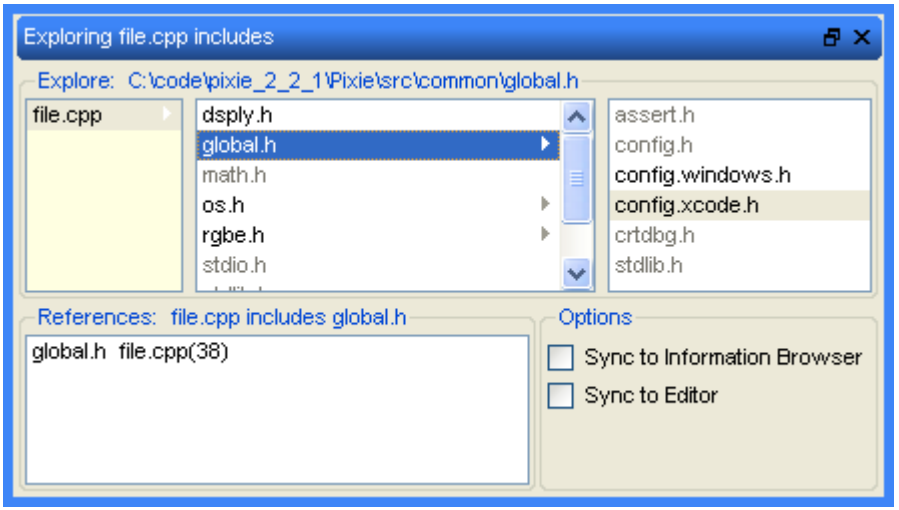
If you double-click a file or entity, the Source Editor for that item opens.

You can select rows on the right and click **Copy Selected** or press Ctrl+C to copy those lines to the clipboard. Click **Copy All** to copy the full list of metrics for the selected directory or file.

Click **Generate Detailed Metrics** to open the Project Metrics dialog, which is described on page page 10–27. For more about metrics, see *Metrics Reports* on page 10–22.

Exploring a Hierarchy

The Exploring view lets you browse up and down a relationship hierarchy within your project.



The right-click menu in the Info Browser, Entity Filter, and Project Browser offers a command to Explore certain types of entities. The command may be **Explore Calls/Callbys** or **Explore Includes/Includebys**.

If you click on an item in one column, you can see its relationships in the columns on either side. As you choose items further to the left or right, the columns become scrollable so you can see more of the hierarchy.

If you double-click an item, a Source Editor window shows the entity's definition.

The **References** area provides more detail on the current relationship.

If you check the **Sync to Information Browser** box, then choosing another entity causes the current item in the Info Browser to reflect your choice.

If you check the **Sync to Editor** box, then choosing another entity causes the current item to be opened in the Source Editor.

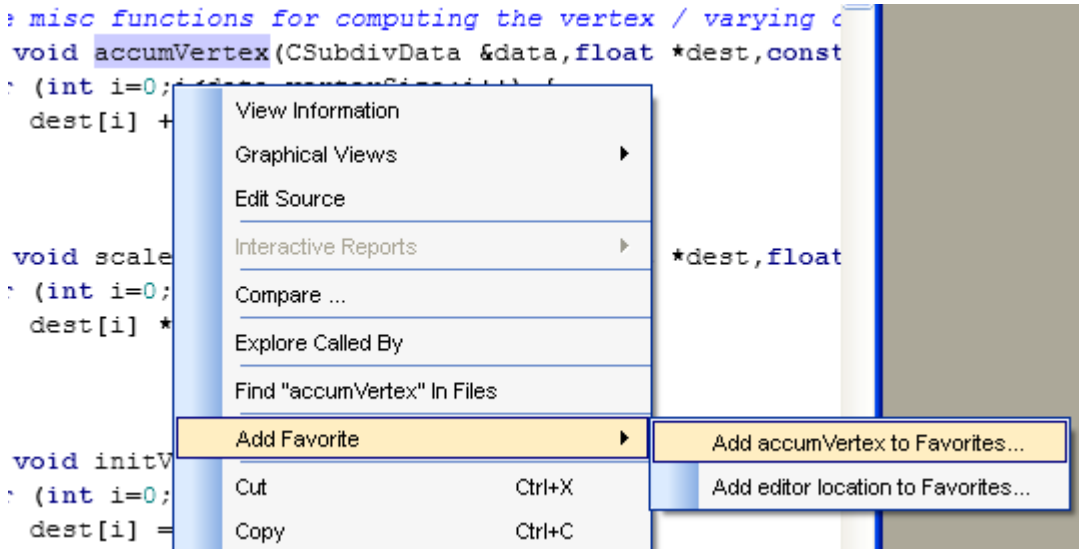
Favorites

You can mark entities as “Favorites” so that you can quickly access them as you would web pages in a browser’s Favorites list.

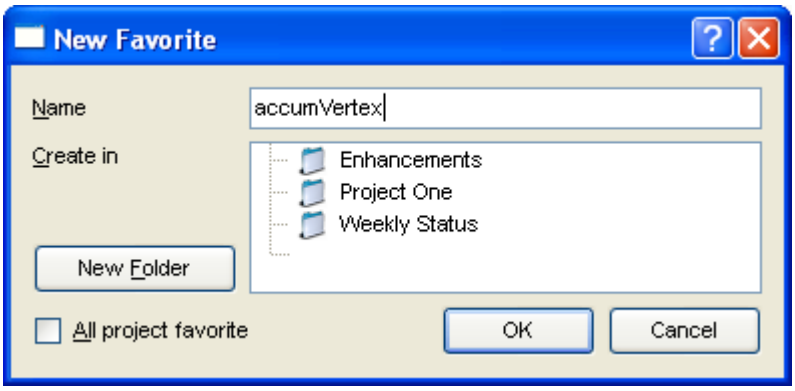
Creating a Favorite

To mark an entity as a favorite, follow these steps:

1 Right-click on an entity in the Entity Filters area, the Info Browser, a source view, a graphical view, or anywhere else entities occur.



2 From the right-click menu, choose **Add Favorite**. In the Source Editor, you can choose to add the entity itself (even if it moves) or the line number. You will see the New Favorites dialog.



3 You can change the **Name** to be shown in the Favorites list.

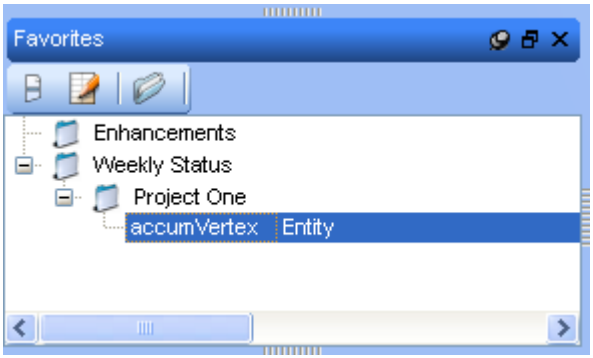
4 In the **Create in** box you can select an existing favorites folder or create a new folder. If you don't select a folder, the favorite will be at the top level.

5 Check the **All project favorite** box if you want this favorite to be available in all projects you create and use.

6 Click **OK** to create the favorite.

Using the Favorites

To open your Favorites list, choose **Search->Show Favorites** from the menus.



You can do the following in the Favorites area:

- Single-click an item to view it in the Info Browser (unless it was saved as an editor location only).
- Double-click an item to see its location in the source.
- Use the **Remove**, **Edit**, and **New Folder** icons in the Favorites toolbar to manage the selected item.
- Drag folders and items around to rearrange them.

Chapter 5 Searching Your Source

This chapter covers how to use *Understand 2.0*'s Find in Files and Entity Locator features to locate thing in your source code.

This chapter contains the following sections:

Section	Page
Searching: An Overview	5–2
Entity Locator	5–3
Find in Files	5–8
Finding Windows	5–11

Searching: An Overview

Finding things in large bodies of source code can be difficult, tedious, and error prone.

Understand 2.0 offers these solutions for finding things:

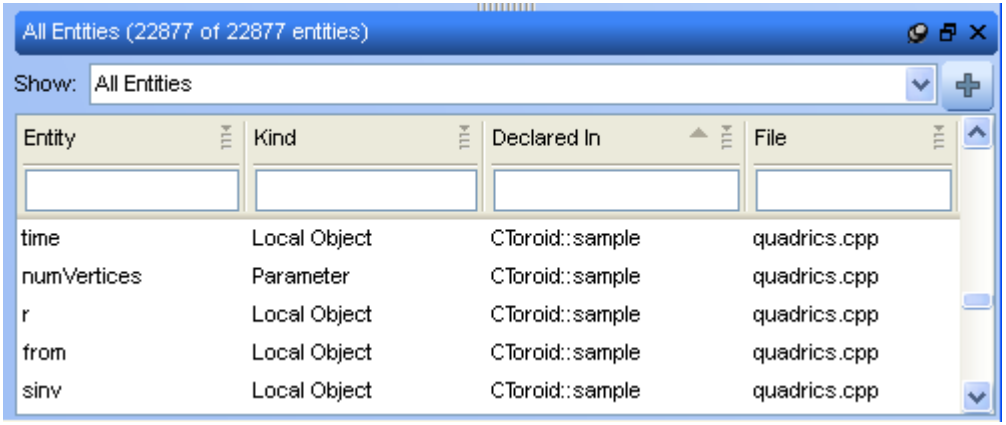
- Project wide, entity only, searching using the Entity Locator. This kind of search finds only entities (not strings, or comments, or non-syntactically declared or used items). See *Entity Locator* on page 5–3.
- Project wide, text-based searching using Find in Files. See *Find in Files* on page 5–8.
- Single file searching in the Editor. See *Searching Source Code* on page 6–6.

Each of these searching methods has advantages and disadvantages. Together they provide powerful ways to easily find what you need to find to better understand and modify your code.

Entity Locator

Not all entities fall into one of the tab categories shown in the *Entity Filter*. You can find and learn more about any entity by using the *Entity Locator*, which provides a filterable list of entities in the database. You can filter by name, by entity type, by where the entity is declared, or within what type of container the entity is declared. You can also use architecture hierarchies to sort entities.

To open the *Entity Locator*, choose the **Search->Entity Locator** from the main menu bar.



As in other windows in *Understand 2.0*, when you right-click on an entity anywhere in the *Entity Locator*, a menu of commands available for the item appears.

Resizing Columns

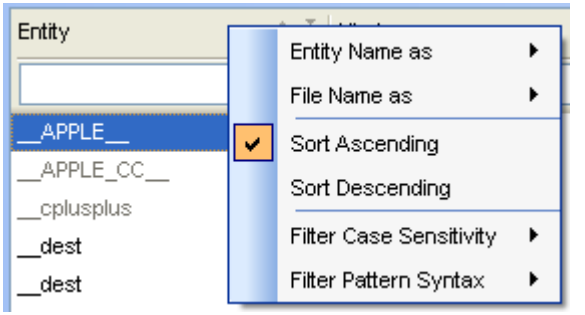
Column widths can be sized to adjust how much of each column is visible. You can drag the column header divider between two columns to resize the column to the left. Or, double-click on the column header divider while the double-headed arrow is displayed and the field to the left of the divider will be expanded or shrunk to the maximum size needed to view all items in that column.

Long versus Short Names

In the *Entity*, *Declared In* and *File* columns, you can right-click the column header to specify the display format for entity names and filenames. For entities, you can choose the short name or a full name that includes the name of the compilation unit. For filenames, you can choose the short, full, or relative path.

Column Headers

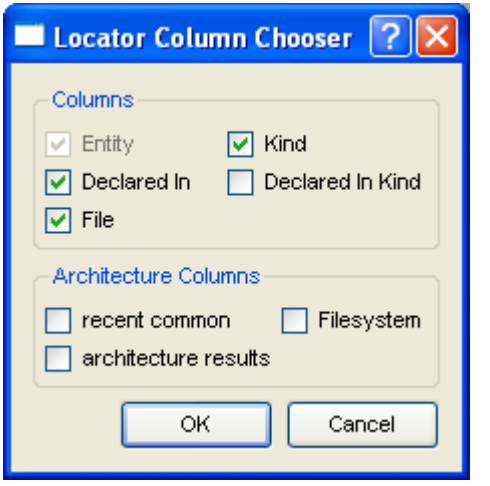
Column headers are tools in the *Entity Locator*. Left-click them to sort according to that column. Right-click a column or click the drop-down icon to see a menu that lets you control how entities are listed, sorted, and filtered.



The entity list may be sorted by any column. Left-click on the column header to toggle between sorting in ascending order and descending order. The default sorting order is in ascending order of entity names.

Choosing Columns

Click the large + icon in the upper-right of the Entity Locator to see the Locator Column Chooser.



The **Entity** column must always be displayed. You can enable or disable the other columns.

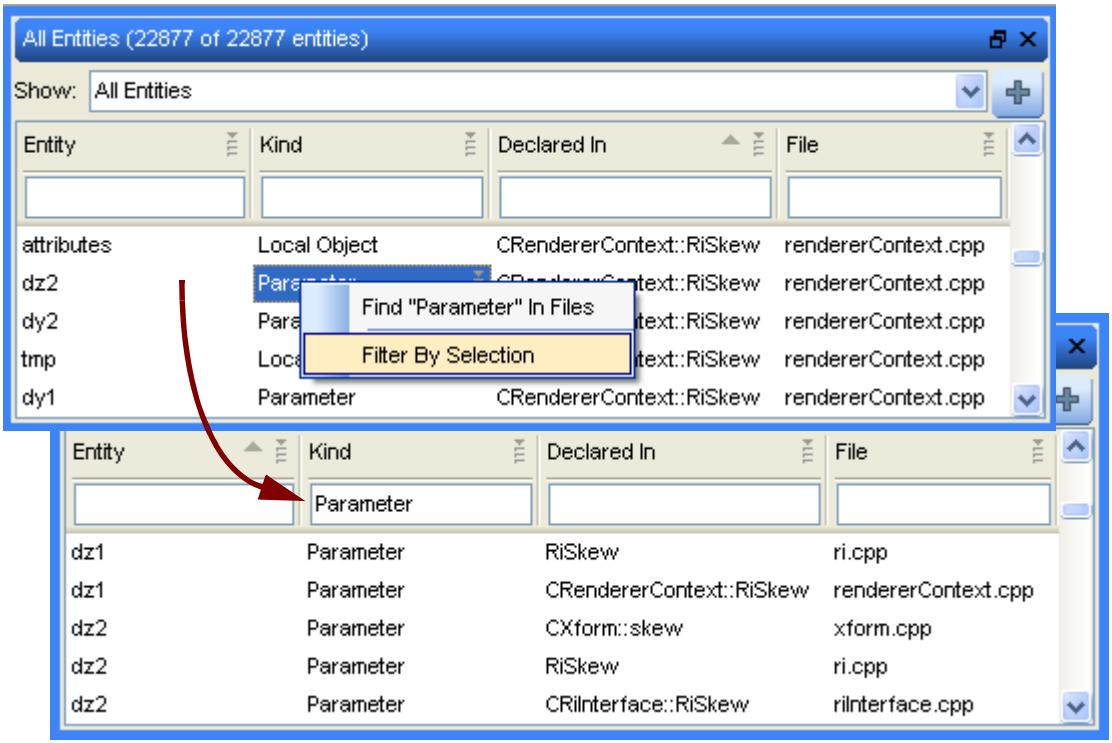
Filtering the List

The field below each column heading lets you filter the entities shown by the *Entity Locator*. The filter can be entered manually or automatically based on what was right-clicked on.

For example, you may filter by the *Kind* column by right-clicking on any item listed in the *Kind* column and selecting **Filter By Selection** from the menu. This filters the list of entities to contain only entities of the kind you selected.

Or, you can simply type a filter in one of the fields. To clear a filter, just delete the text from the field in the column heading.

The following example shows **Filter By Selection** for an entity *Kind:*



Right-click a column or click the drop-down icon to see the context menu for that column. You can choose for the filter case sensitivity to be **Case Sensitive** or **Case Insensitive** (the default). You can also choose for the filter pattern matching syntax to use fixed strings (the default), wildcards, or regular expressions.

- **Fixed string.** The string you type matches if that exact string is found anywhere in the column value.

- **Wildcard.** These are * or ?, where * matches any string of any length and ? matches a single character. For example, ??ext_io matches any name having 8 letters and ending in *ext_io.*
- **Regular expression.** A powerful and precise way to filter and manipulate text. You cannot use the **Case Sensitive** option if you are using regular expressions.

The following table lists some special characters used in regular expressions.

Symbol	Description	Example
^	Match at the beginning of a line only.	*^word* Finds lines with w in the first column.
$	Match at end of a line only.	*word$* Finds lines that end with “word” (no white space follows word).
\<	Match at beginning of word only.	*\<word* Finds wordless and wordly but not fullword or awordinthemiddle.
\>	Match at end of word only.	*\<word* Finds keyword and sword but not wordless or awordinthemiddle.
.	A period matches any single character.	*w.rd* Finds lines containing word, ward, w3rd, forward, and so on, anywhere on the line.
*	Asterisk matches zero or more occurrences of the previous character or expression.	*word** Finds word, wor, work, and so on.
+	Match one or more occurrences of the previous character or expression.	*wor+d* Finds word, worrd, worrrd, and so on.
?	Match zero or one occurrences of the previous character or expression.	*wor?d* Finds word and wod.
[ ]	Match any one of the characters in brackets but no others.	*[AZ]* Finds any line that contains A or Z. *[Kk][eE][Nn]* Finds any variation of case when spelling "Ken" or "KEn" or "keN".
[^]	Match any character except those inside the brackets.	*[^AZ]* Finds any line that does not contain the letters A or Z.

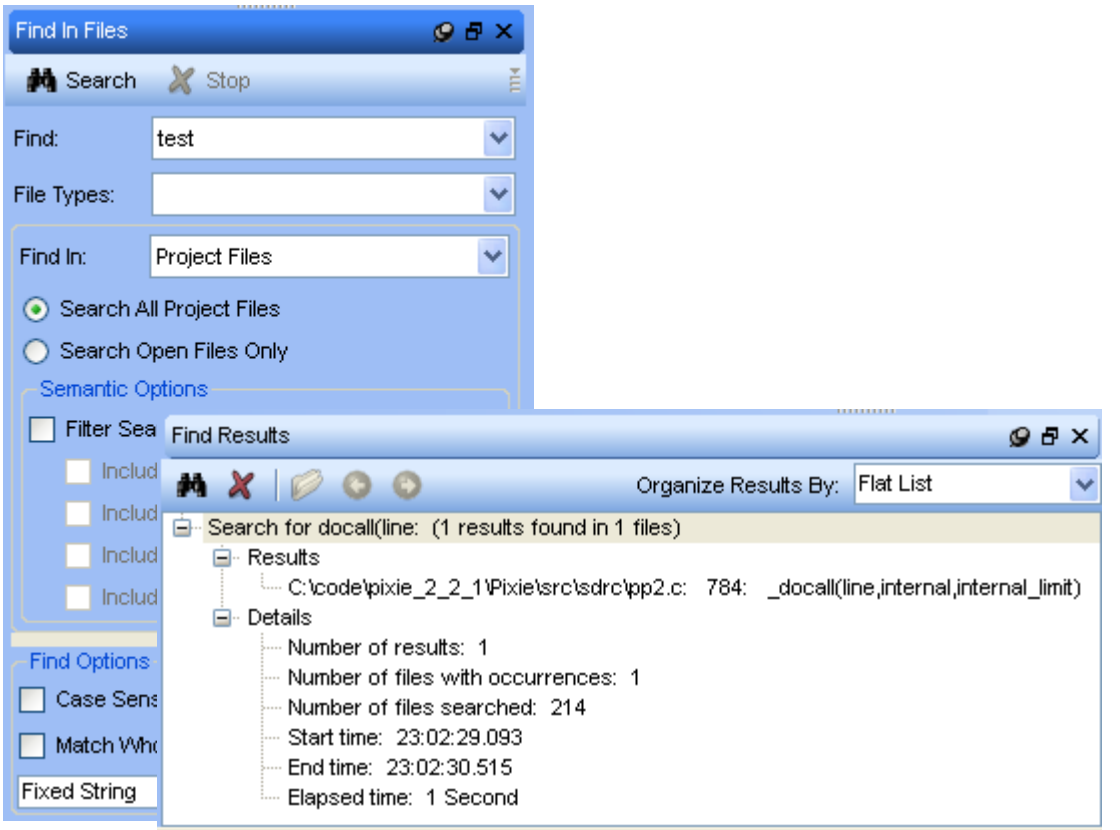
Symbol	Description	Example
[-]	Match a range of characters.	*[A..Z]* Finds any line containing letters A through Z on them but not lower case letters
|	A vertical bar acts as an OR to combine two alternatives into a single expression.	*word* | *let+er* Finds word, leter, letter, lettter, and so on.
\	Make a regular-expression symbol a literal character.	**/$* Allows searching for *. This example finds all lines ending in */

A full explanation of regular expressions is beyond the scope of this manual. UNIX users may refer to the manual page for *regex* using the command "*man -k regex".* For a comprehensive explanation of *regex* expressions we refer you to the book "*Mastering Regular Expressions*", published by O'Reilly and Associates (www.ora.com/catalog/regex or 1-800-889-8969).

Find in Files

You may search the project files or another selection of files for the occurrence of a text string or regular expression. Matches are shown in the *Find Results* window and can be visited in the source code by double-clicking on any line in the results.

To open this dialog, choose **Search->Find in Files** from the menu bar, choose **Find in Files** from any right-click menu, or press F5.



The Find in Files dialog allows you to search multiple files for the occurrence of a string. In previous versions, this feature was called Hyper Grep for its similarity to the UNIX command *grep*.

The **Find in Files** function is available when you right-click on an item in other windows.

In the Find in Files dialog, specify a search as follows:

- **Find.** Type the string you want to search for. The other fields control how this search is performed.
- **File Types.** You can select file extensions for various source code languages to narrow the search. Or, type your own file extension pattern.
- **Find In.** Choose whether to search based on project files (either all or just the open files), architecture nodes you select, directories you select, or files you select.

The boxes in the **Semantic Options** area let you control which matches are reported. Put a check in the **Filter Search Results** if you want to limit results to certain types of lines. Then you can check any combination of the **Include Comments**, **Include Strings**, **Include Statements**, and **Include Inactive Code** boxes to include those types of lines in the results. You must check at least one of the Include boxes if you check the Filter Search Results box.

The fields in the **Find Options** area (which can be hidden with the icon) let you set the following options:

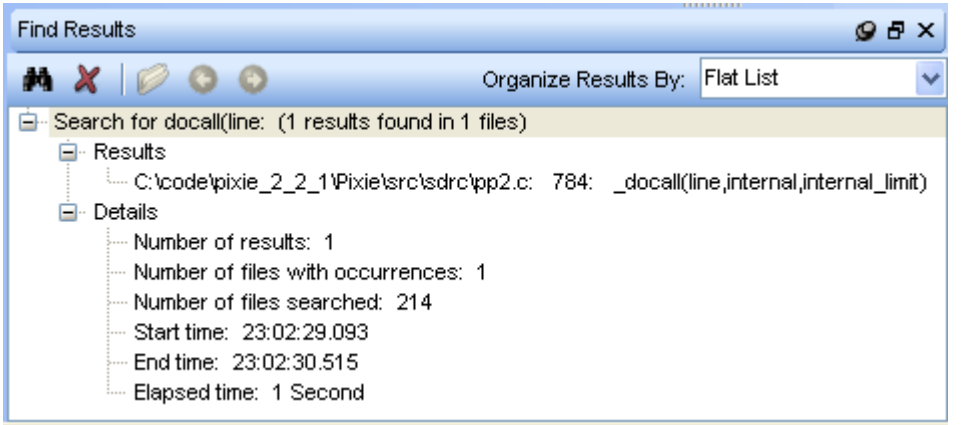
- **Case Sensitive.** Choose case-sensitive or case-insensitive (the default) searching.
- **Match Whole Words.** Choose whether to match whole words only (“test” matches “test” but not “testing”) or to ignore word boundaries.
- **Pattern Syntax.** Choose whether to use fixed string, wildcard, or regular expression matching. See page 5–5 for details.

Press the **Search** button after specifying the search criteria. A list of all occurrences of the string will be displayed in the *Find Results* window.

Find Results

In the Find Results window, you can view the occurrence found by double-clicking on a results entry. This opens the Source Editor and highlights the match.

The Details in the Find Results window contains information about the search that was performed.



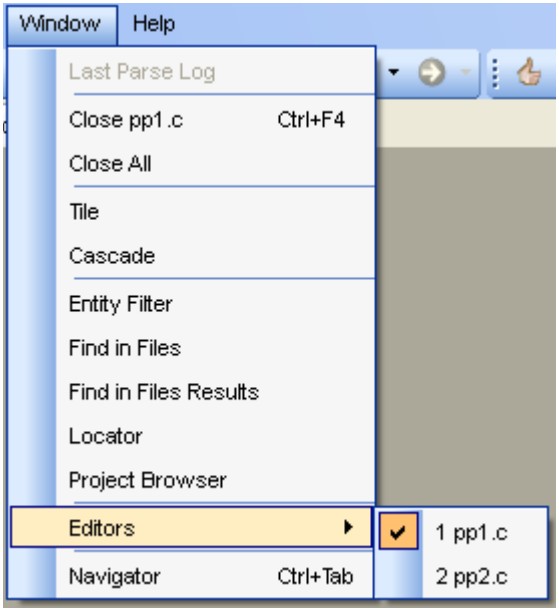
Multiple searches are shown in the results tree. You can right-click on the background of the window and choose **Expand All** to expand all nodes in the window. Or, choose **Collapse All** to compress the list to just the top-level search listing.

From the right-click menu, you can choose **Copy** or **Copy All** to copy the current contents of the window as text for pasting elsewhere.

The toolbar for the Find Results area lets you search within the results, delete the current set of results, open the selected occurrence in the Source Editor, or move to the previous or next occurrence. You can also use the toolbar to choose how the results are sorted.

Finding Windows

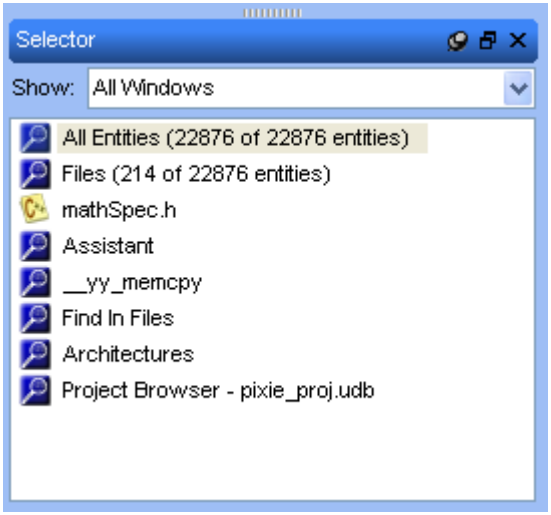
If you have a number of windows open, you can use the options in the **Window** menu to organize or find particular windows.



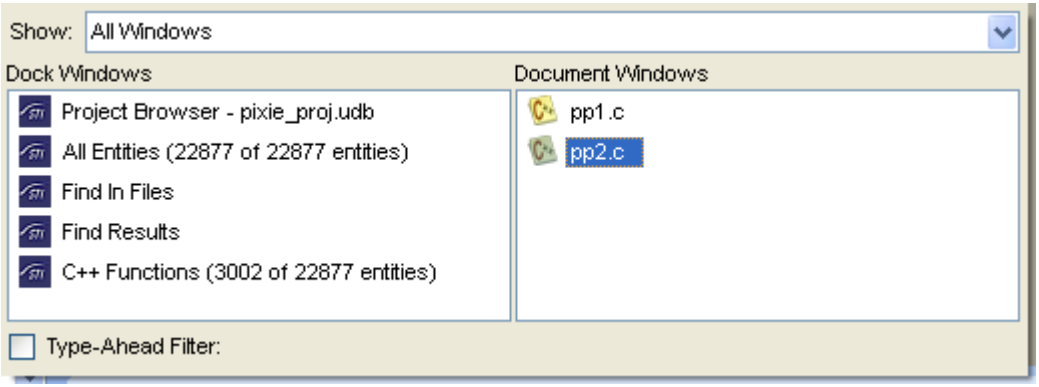
The Window menu lets you **Tile** or **Cascade** the open windows.

After the Cascade command, the Window menu lists the windows you currently have open. You can select one of these windows to move focus to that window.

The **Window->Selector** command opens an area that lists currently open source file windows. By default it lists all windows, but you can choose to show only Editor windows or various other window types. The most recently used windows are at the top of the list. Double-click an item in this list to give that item focus.



The **Window->Navigator** command (Ctrl+Tab) opens a list of currently open source file windows. When you double-click on an item in this list, the list goes away and focus is given to the item you chose.



If you check the **Type-Ahead Filter** box, the list of windows is filtered to match the string you type after checking the box.

If you have a lot of windows open in the document area, you can right-click on the title bar of the window you are using and choose **Close All But This**.

Chapter 6 Editing Your Source

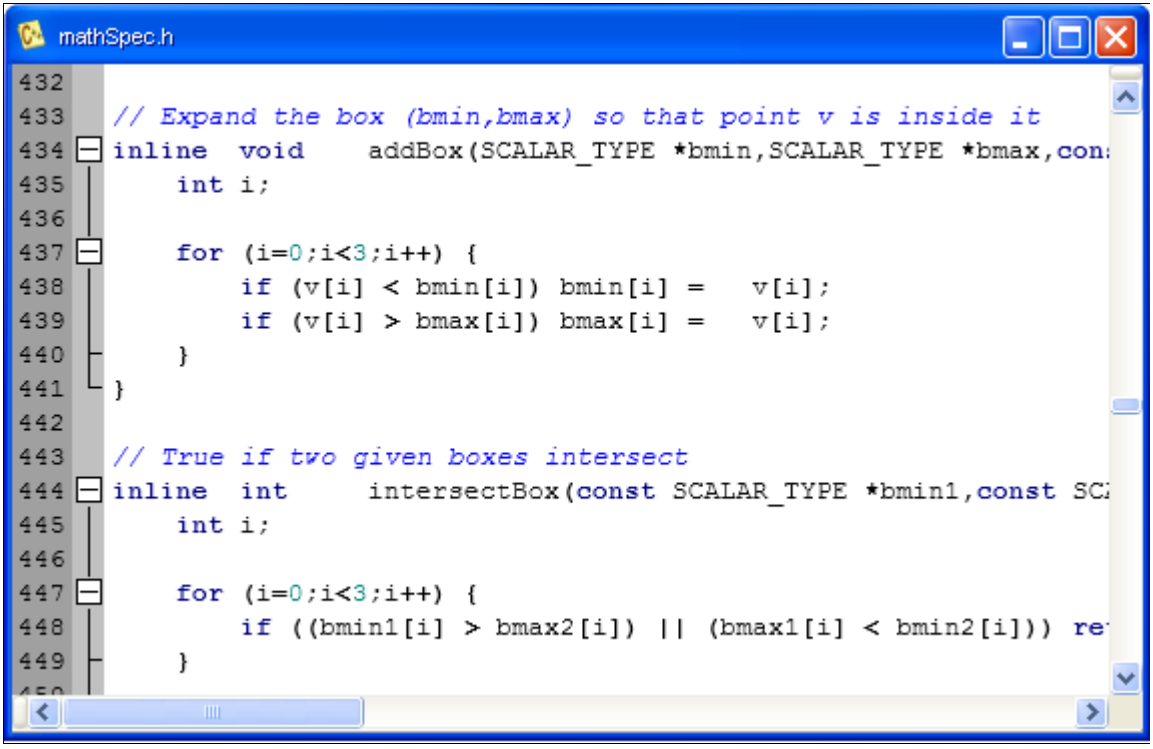
This chapter covers *Understand 2.0*'s source and text file editor.

This chapter contains the following sections:

Section	Page
Source Editor	6–2
Saving Source Code	6–5
Searching Source Code	6–6
Other Features	6–8
Printing Source Views	6–9

Source Editor

The **Source Editor** offers a full featured source code editor, with syntax coloring and right-click access to information most entities in your code.

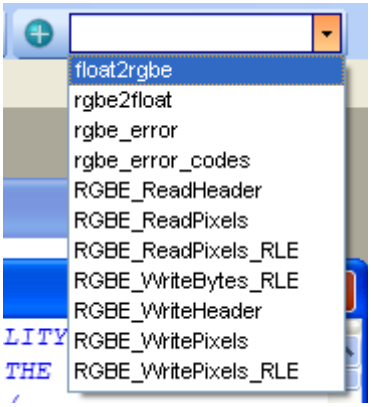


The line numbers and “fold” markings to expand/collapse blocks of code can be turned on and off in the **Editor** category of the Software Options dialog you can open with the **Tools->Options** command (see page 3–54). The display font and a number of other items can also be changed in the **Editor** category. You can also enable an indent guide marking and a right margin marker in that category of the dialog.

The **Editor->Styles** category of the Software Options dialog (see page 3–56) lets you change the colors used for different types of source code. The **Key Bindings** category (see page 3–51) shows a list (and lets you modify the list) of keystrokes you can use in the Source Editor.

Scope List

You can jump to a particular function, procedure, or other language-specific construct in the current source file by selecting from the scope drop-down list in the toolbar. The drop-down list shows all such constructs found in the file the last time the project was analyzed.



You can click the + icon to move the list to a Scope tab in the area where the Entity Filter is shown. This tab lists the constructs in the currently selected source file. This tab is useful for jumping around in large files.

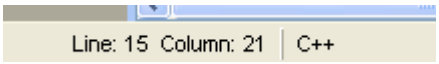
Status Icons

Each file in a Source Editor window has a status icon in its upper-left title bar. The letter inside the icon indicates the type of file. The color of the icon indicates whether the file has been modified but not yet analyzed. An asterisk next to the filename marks files with unsaved changes.

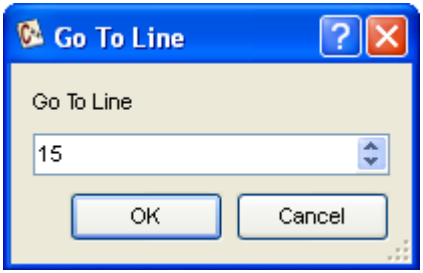
- Yellow icon = parsed project file (has not been modified)
- Red icon = modified project file (needs to be parsed)
- White icon = file not in the project

Status Line

When a Source Editor is the active window, the status bar at the bottom of the *Understand 2.0* window shows the line number, column number, and source language at a quick glance:



If you click on the line number in the status bar, a Go To Line dialog appears.



Selecting and Copying Text

Text can be selected (marked) then cut or copied into the Windows (or X11) clipboard. Selecting text works as standard for the operating system in use. For Windows dragging while holding down the left mouse selects text. Alternately you can hold down the Shift key and move the cursor (via arrows or the mouse).

Once you select text, you can use the **Cut** and **Copy** commands in the **Edit** menu or on the right-click menu. You may then paste the text into other applications as needed.

Browse Mode

You can switch the Source Editors to “Browse” mode by clicking the Browse button in the main toolbar. When you are in Browse mode, the icon is highlighted.

You can temporarily enter Browse Mode by holding down the Ctrl key while using a Source Editor window.

In Browse Mode, entities in the code act as links. An underline is shown when your mouse cursor moves to a link. Clicking a link moves you to the declaration of that entity and updates the Info Browser to show details about that entity.

If the declaration of an entity you click on is not found, a message is shown in the status bar and your computer beeps.

When you are in Browse Mode, you can still edit the file and the keyboard and right-click function the same as in regular mode. Only left-clicking the mouse is different.

See page 3–57 for settings to control the behavior of Browse Mode.

Right-Click Menu

The right-click menu in the Source Editor provides access to a number of exploration and editing features.

The following exploration features are typically included in the right-click menu (depending on where you click):

- View Information (see page 4–8)
- Graphical Views (see Chapter 9)
- Compare (see Chapter 8)
- Explore Relationships (see page 4–16)
- Find in Files (see page 5–8)

- Add Favorite (see page 4–17)

The following editing features are typically included in the right-click menu:

- Undo
- Cut / Copy / Paste (see page 6–4)
- Select All
- Revert (see page 6–5)
- Hide/Show Inactive Lines (see page 6–8)
- Fold All (see page 6–8)
- Comment Selection / Uncomment Selection (see page 6–9)
- Change Case (see page 6–8)

Saving Source Code

If you have edited a source file, you can click , press Ctrl+S, or choose **File->Save** to save your changes.

You can choose **File->Save As** to save to a different filename. If you save a project file to another filename, you will be asked whether you want to add the new file to the project.

If you have edited multiple source files, you can click or choose **File->Save All** to save changes to all modified files.

If you want to ignore changes you have made choose since the last save, right-click in a file and choose **Revert**.

Searching Source Code

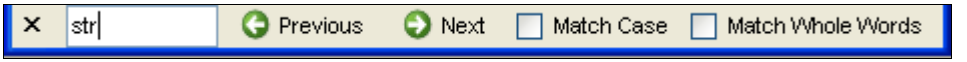
There are a number of ways to search for strings in your source code or to locate particular lines. The commands for these options are located in the **Search** menu. These commands are described in the locations listed in the following table:

Search Menu Command	See
Entity Locator	page 5–3
Find in Files	page 5–8
Incremental Find	page 6–6
Find	page 6–7
History	page 6–7
Bracket Matching	page 6–8
Favorites	page 4–17

See page 4–3 for a more complete list of the code exploration tools in *Understand 2.0*.

Incremental Find

To search quickly within the current file, press Ctrl+F (or choose **Search->Incremental Find**). The status bar of the Source Editor changes to a search bar.



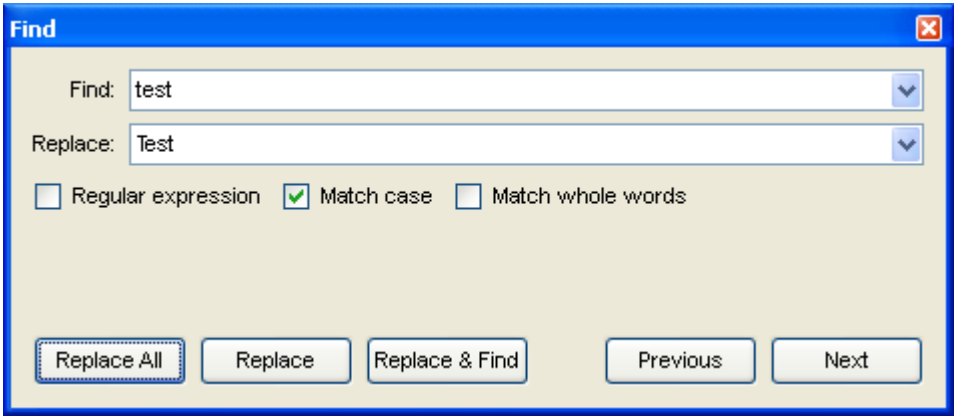
You can type a string in the field. As you type, matches for that string are highlighted in the Source Editor. Click **Previous** or **Next** to move from match to match. You can also check the **Match Case** and **Match Whole Words** boxes to modify how the search is performed.

As soon as you click on the code, the incremental search bar is hidden. When you press Ctrl+F again, your last search is shown.

Use Ctrl+Shift+F to find the previous occurrence.

Find

If you want to use Search-and-Replace or regular expressions for searching, you can use the Find dialog. To open this dialog, choose the **Search->Find** menu item or press Ctrl+Alt+F.



In the **Find** field, type the string you want to find.

You can check the **Regular expression**, **Match case**, and **Match whole words** boxes to modify how the search is performed. If you check the **Regular expression** box, you can use UNIX-style pattern matching. For a list of some of the capabilities of regular expressions, see page 5–5.

If you want to replace the string you are finding, type that in the **Replace** field.

Click **Previous** or **Next** to search in either direction. Click **Replace All**, **Replace**, or **Replace & Find** if you want to replace the string that was found.

The Find dialog searches only individual files. To search multiple files, see *Find in Files* on page 5–8.

Source Visiting History

You can move forward or backward through the history of your source code visiting locations using **Previous** and **Next** icons in the toolbar. This history is stored even between *Understand 2.0* sessions.

You can click the down-arrows to see the full list of source locations in the history.

The source locations are stored as line numbers, not by entity name. If you want to save locations by entity rather than line number, see *Favorites* on page 4–17.

Other Features

The Source Editor also provides several other options for displaying and editing files.

Bracket Matching

A handy feature of the *Understand* editor is syntax bracket matching. Use this feature to find the matching ending bracket of syntactically used braces, parenthesis and brackets. Symbols matched are ( ), { }, and [ ]. Matching isn't done inside comments.

Pressing Ctrl+j jumps the editor to the matching end or beginning brace. Ctrl+j isn't active unless over a symbol that it can match. Another Ctrl+j takes you back where you started.

Pressing Ctrl+Shift+J selects all the text from the bracket to its matching bracket.

Brackets without a match are highlighted in red when you move your cursor to them. Brackets with a match are highlighted in green.

Folding and Hiding

The - and + markings next to the line numbers allow you to "fold" the code to hide blocks such as functions, if statements, and other statements that have a beginning and end.

If you right-click on the code, you can choose **Fold All** to close all the open blocks.

You can also choose **Hide Inactive Lines** to hide preprocessor lines that are not active because a preprocessor macro is not defined. Choose **Show Inactive Lines** to view all lines again.

Changing Case

You can change the case of selected text in the Source Editor. Follow these steps:

1. Select a word or words in the source code.
2. Right-click and choose **Change Case** from the pop-up menu.
3. Choose the type of case you want to apply to the selection. The choices are as follows:

Choice	Default Keystroke	Original	Result
Upper Case	Ctrl+Shift+U	Test_me	TEST_ME
Lower Case	Ctrl+U	Test_me	test_me
Invert Case	Ctrl+Shift+I	Test_me	tEST_ME
Capitalize	Ctrl+Alt+U	Test_me	Test_Me

Commenting and Uncommenting

You can comment code that you have selected by right-clicking and choosing **Comment Selection**. To remove the comment characters, right-click and choose **Uncomment Selection**.

Not that nested comments within the selection are not parsed.

Keyboard Commands

To see a list of keystrokes that work in the Source Editor, choose **Tools->Options** and go to the **Key Bindings** category. For example, Ctrl+Alt+K cuts the text from the cursor position to the end of the line. And, Ctrl+T transposes the line at the cursor position with the line above it.

Printing Source Views

The menu option **File->Print** sends the currently viewed source file to the printer. The printout will use 66 lines per page. As with other printing, the Windows driver setup is used on Windows.

By default, files are printed in the font and color shown on the screen when you choose the **File->Print** menu option.

On UNIX machines *Understand 2.0* uses Postscript as its primary output format. The output files created are Level 2, Encapsulated Postscript without a preview image. All output is to a file, the file can optionally be sent to a queuing command (such as *lp* or *lpr*).

Chapter 7 Architecting Your Codebase

This chapter is explains the architecture features provided by *Understand 2.0* and explains how you can use them to analyze your code.

This chapter contains the following sections:

Section	Page
About Architectures	7–2
Using an Architecture as a Browser	7–3
Managing Architectures	7–9
Creating an Architecture	7–10
Editing an Architecture	7–12
Using XML to Manage Architectures	7–14
Using Architecture Filters	7–15

About Architectures

An architecture is an abstract hierarchy layered onto a body of source code. For example, a staff architecture could have nodes for each engineer working on a particular project. The nodes would contain a list of source code files belonging to or to be modified by that engineer. Dependencies and interactions could then be derived from that architecture.

Architectures allow you to name regions of a software project or ways of looking at software hierarchically. An architecture creates a hierarchy of source code units (entities). You can use the provided architectures or create your own.

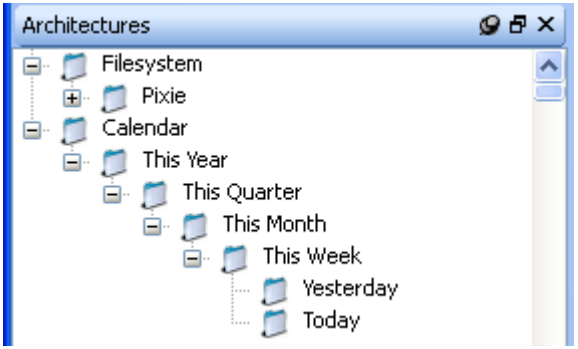
Architectures need not reference every source entity in the database; that is, they can define a subset of the entities. Also, architectures can contain a particular entity more than once. (Technically, that is, the architecture's flattened expansion need not maintain the set property.)

You can combine architectures successively to create novel filters for your entities.

From a more technical perspective, simple set algebra is used to combine and transform architecture hierarchies. The result of the filter is a list of entities. This result list can be viewed as a flat list or in terms of another architecture. The filter definition can be saved as a dynamic architecture. A dynamic filter architecture is updated as the contents of the database change and it can be used to reconstitute the filter at a later date.

Using an Architecture as a Browser

To open the Architecture Browser, choose **Architect->Browse Architectures** from the main menubar.



You see an expandable list of the architectures currently defined for your project. *Understand 2.0* provides some “auto-architectures” that are built in. These are Filesystem (for viewing the project in its normal file hierarchy) and Calendar (for viewing the project files by their latest update). The Calendar architecture is disabled by default for performance reasons; see page 7–9 for how to enable it.

This Architectures area is similar to the Filters area. When you click on an item, information about it is automatically shown in the Info Browser (as long as the “sync” box is checked in the Info Browser).

Exploring Architectures

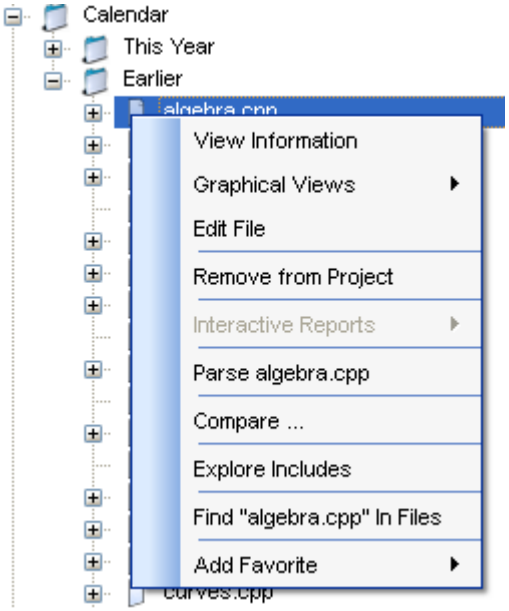
To explore the existing architectures, click the “+” signs to expand the hierarchy. Entities, such as files, functions, and variables are shown in the hierarchies. The following auto-architectures are provided:

- **Filesystem.** Lists directories in the project and their subdirectories. Your source code files are listed where they occur in the directory hierarchy and their functions and variables (or similar entities) are listed below them in the hierarchy.
- **Calendar:** Lists files in the project by when they were last changed. A hierarchy of dates is shown that progresses from This Year, This Quarter, This Month, and This Week to Yesterday and Today. Beneath the filename, the functions and variables (or similar entities) are listed as in the Alphabetic architecture. The Calendar architecture is disabled by default for performance reasons; see page 7–9 for how to enable it.

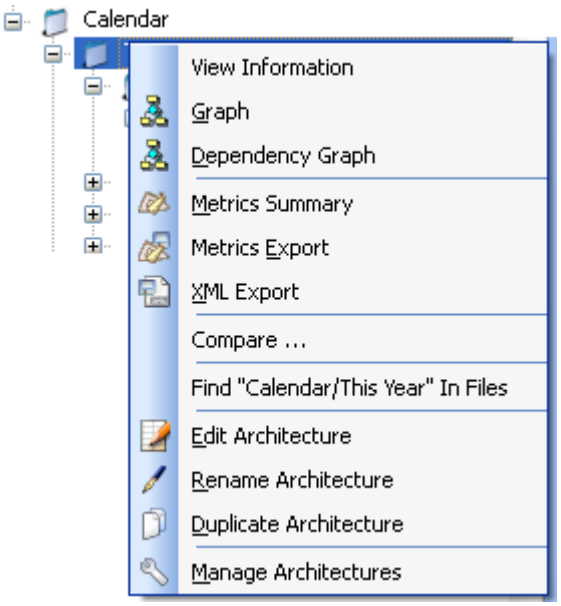
The auto-architectures are updated only when the project is analyzed. So, if your source code is actively being modified and you have not analyzed it recently, architectures—especially the Calendar architecture—could be out-of-date.

You can right-click on any item in the Architecture Browser to get a list of information you can view about that item.

Right-click on file in Architecture



Right-click on Architecture node



Notice that the right-click menu for an architecture node (such as a filesystem directory or “This Quarter” contains some extra items not available in other right-click menus:

- **Graph.** Creates a graph of the architecture hierarchy from this point down. You are asked whether you want to include entities in the graph or just the architecture nodes. See page 7–6.
- **Dependency Graph.** Shows the dependencies between architecture nodes. See page 7–6.
- **Metrics Summary.** Provides metrics for the entities within the selected node. The metrics are based on entities in the current node, but not those in sub-nodes lower in the hierarchy. See page 7–7.
- **Metrics Export.** Creates a CSV output of the metrics from the Metrics Summary. See page 7–7.

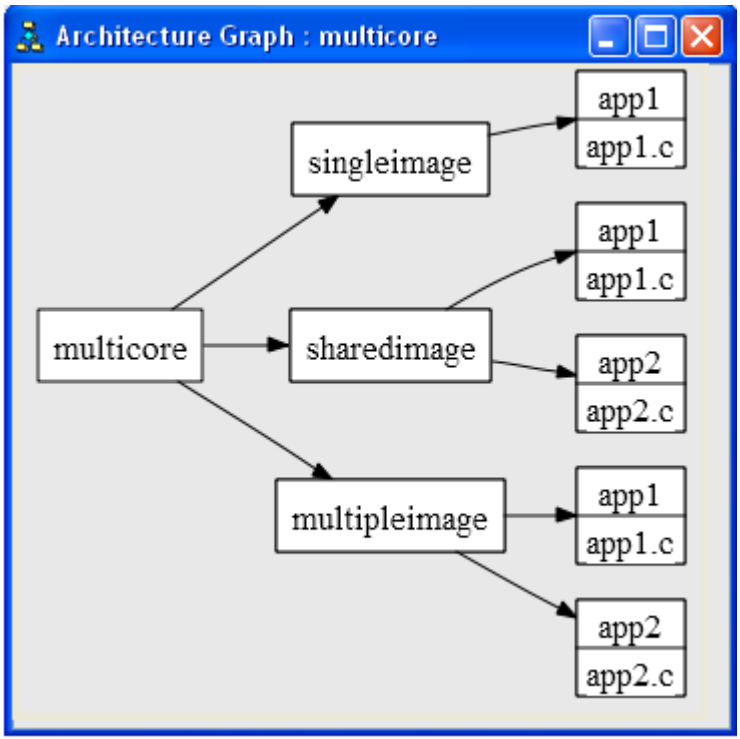
- **XML Export.** Creates an XML export listing the architecture nodes and entities from the selected point down in the hierarchy. See page 7–14.
- **Edit Architecture.** Opens the Architecture Editor for the selected architecture if it is one you created. You cannot edit the auto-architectures provided with *Understand 2.0*. See page 7–12.
- **Rename Architecture.** Opens a Rename Architecture window that lets you rename the selected architecture if it is one you created. You cannot rename the auto-architectures provided with *Understand 2.0*. See page 7–10.
- **Duplicate Architecture.** Opens a Duplicate Architecture window that lets you type a name for a duplicate copy of the selected architecture. See page 7–10.
- **Manage Architectures.** Opens the Architect Manager window. See page 7–9.

Generating Graphs

You can generate graphs that show the hierarchy of an architecture. You can save these graphs as PNG, JPEG, SVG, and Visio files.

To create a graph, follow these steps:

1. Select the highest-level node of the architecture you want to graph. You can graph the entire architecture hierarchy or just a sub-hierarchy.
2. Right-click on the node and choose **Graph** or **Dependency Graph** from the right-click menu.
3. You are asked whether you want to include entities in the graph. Click **Yes** or **No**.
4. You see the graph and can scroll the window as needed. For example, the following architecture graph shows a directory structure starting from a subdirectory called “multicore”.



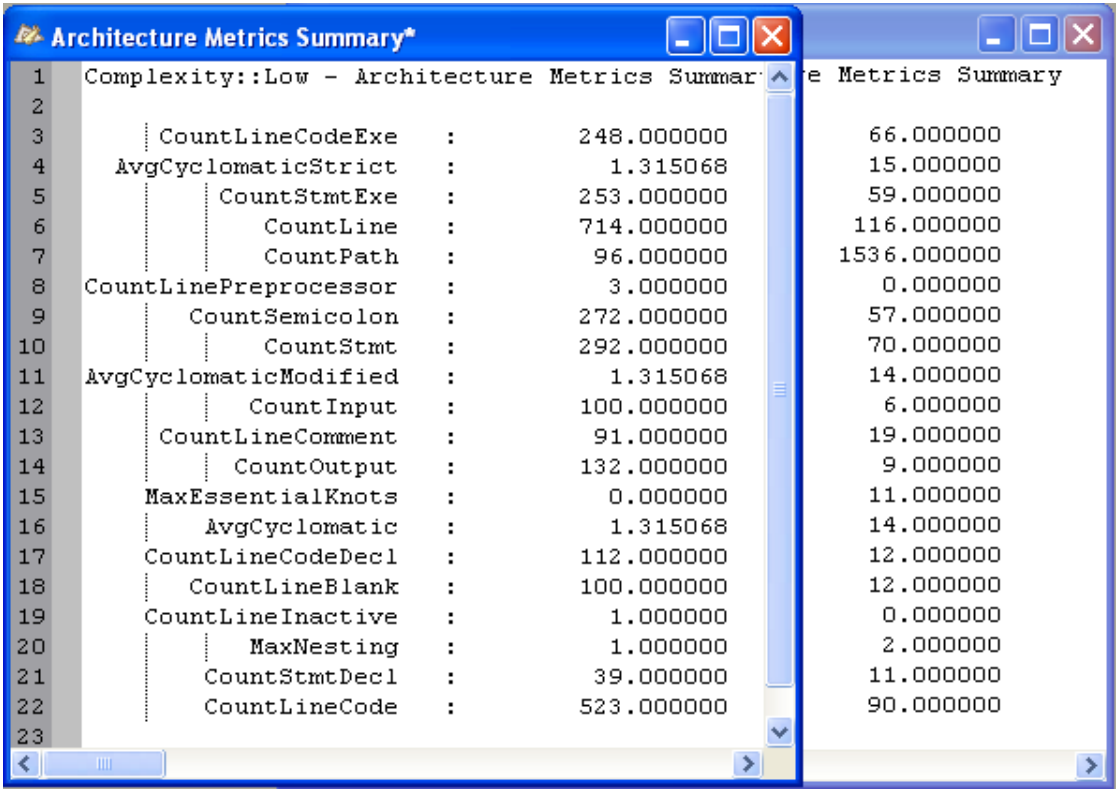
5. To save the graph, right-click and select **Export to Image File** or **Export to Visio File**. Export to Image File lets you save to a JPG, PNG, or SVG file. See page 9–28 for more about these formats. See page 9–29 for more about Visio files.

Generating Metrics

You can generate metrics information about an architecture or a subset of an architecture. The metrics information can be either a text summary or a comma-separated list for use in spreadsheets.

To create a metrics summary, follow these steps:

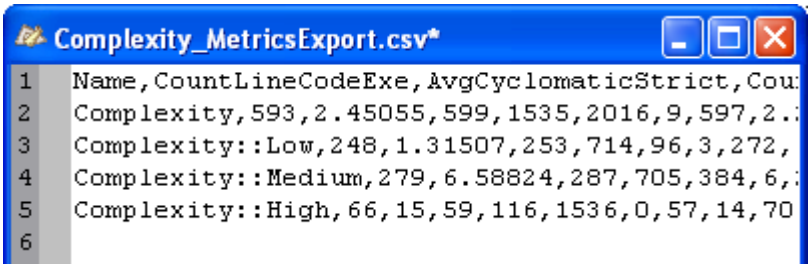
1. Select the highest-level node of the architecture for which you want metrics.
2. Right-click on the node and choose **Metrics Summary** from the right-click menu.
3. You see an Architecture Metrics Summary window. For example, the following two summaries use the Complexity architecture to compare metrics for “Low Complexity” and “High Complexity” functions.


Architecture Metrics Summary*
Complexity::Low - Architecture Metrics Summar
e Metrics Summary
CountLineCodeExe : 248.000000 66.000000
AvgCyclomaticStrict : 1.315068 15.000000
CountStmtExe : 253.000000 59.000000
CountLine : 714.000000 116.000000
CountPath : 96.000000 1536.000000
CountLinePreprocessor : 3.000000 0.000000
CountSemicolon : 272.000000 57.000000
CountStmt : 292.000000 70.000000
AvgCyclomaticModified : 1.315068 14.000000
CountInput : 100.000000 6.000000
CountLineComment : 91.000000 19.000000
CountOutput : 132.000000 9.000000
MaxEssentialKnots : 0.000000 11.000000
AvgCyclomatic : 1.315068 14.000000
CountLineCodeDecl : 112.000000 12.000000
CountLineBlank : 100.000000 12.000000
CountLineInactive : 1.000000 0.000000
MaxNesting : 1.000000 2.000000
CountStmtDecl : 39.000000 11.000000
CountLineCode : 523.000000 90.000000

4. When you close the window, you are asked whether you want to save the file. If you click **Save**, you can save the summary as text.

To create a metrics export file, follow these steps:

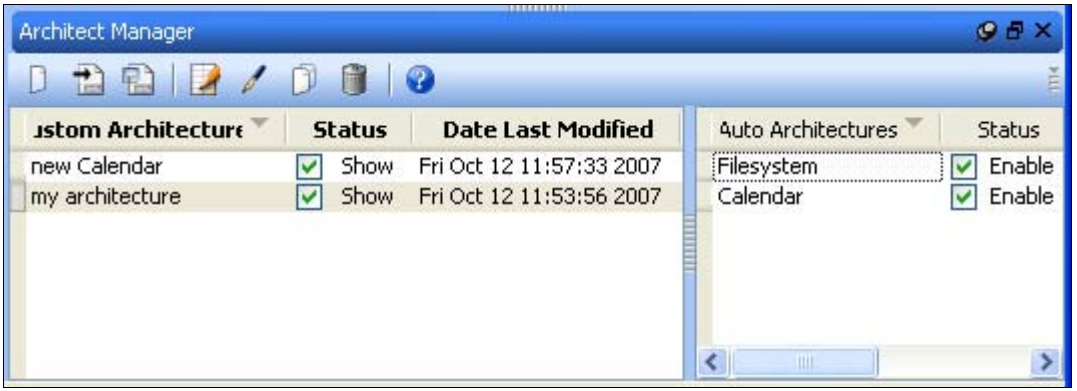
1. Select the highest-level node of the architecture for which you want metrics.
2. Right-click on the node and choose **Metrics Export** from the right-click menu.
3. You see a comma-separated values file. The heading label for each column is in the first row. Each node in the architecture hierarchy has a separate row with metrics for that node's contents.



4. When you close the window, you are asked whether you want to save the file. If you click **Save**, you can save the data as a .CSV file.

Managing Architectures

To open the Architect Manager window, choose **Architect-> Manage Architectures** from the main menubar in *Understand 2.0*. The window lists the auto-architectures on the right and custom architectures you have created on the left.



The checkboxes allow you to control whether custom and auto architectures are shown in the Architectures area. Removing the checkmark next to an architecture can improve performance, especially for large projects. So, you might want to disable/hide architectures you never or rarely use.

You can use the icons at the top of this area or right-click on an architecture to perform the following actions:

- **Create a new architecture.** See page 7–10.
- **Import architecture from XML.** See page 7–14.
- **Export architecture to XML.** See page 7–14.
- **Edit architecture.** Custom architectures only. See page 7–12.
- **Rename architecture.** Custom architectures only. See page 7–10.
- **Duplicate architecture.** See page 7–10.
- **Delete architecture.** Custom architectures only.

Creating an Architecture

There are several ways to create a new architecture:

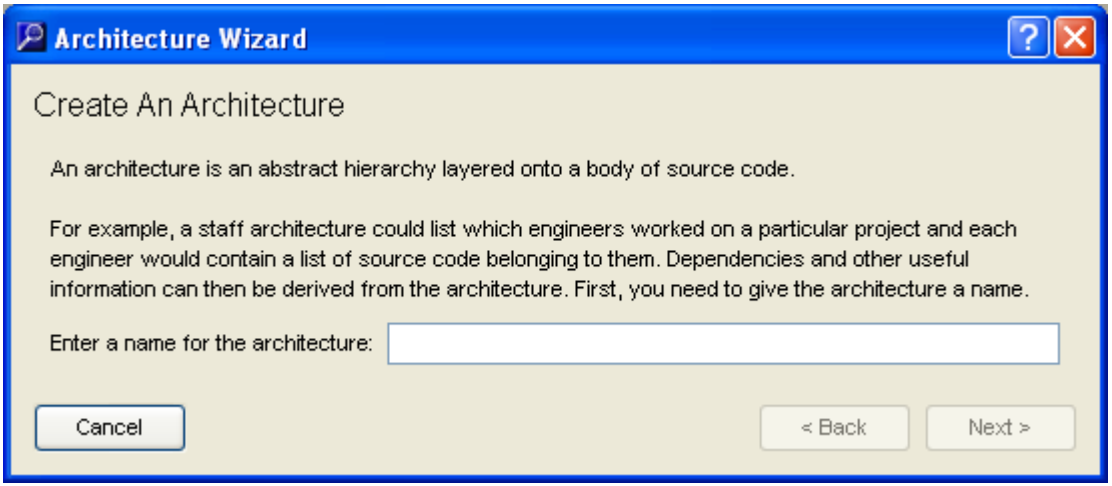
- To create an architecture from scratch, choose **Architect->New Architecture** from the menus or click the icon in the Architect Manager window. Use the Architecture Wizard to create the architecture as described in *Using the Architecture Wizard* on page 7–11.
- To duplicate an existing architecture (which you can then modify), select an architecture and click the icon in the Architect Manager window. Or, right-click an existing architecture and choose **Duplicate Architecture** from the right-click menu.

You can rename an architecture you have created by selecting an architecture and clicking the icon in the Architect Manager window. Or, right-click on an existing custom architecture and choose **Rename Architecture** from the right-click menu.

The Project Assistant suggests some custom architectures you might want to create: Staff (nodes for the code handled by each engineer on the project), Functional Decomposition (nodes for the code making up the major components of the project), and Requirements (nodes for the code affected by various sub-projects).

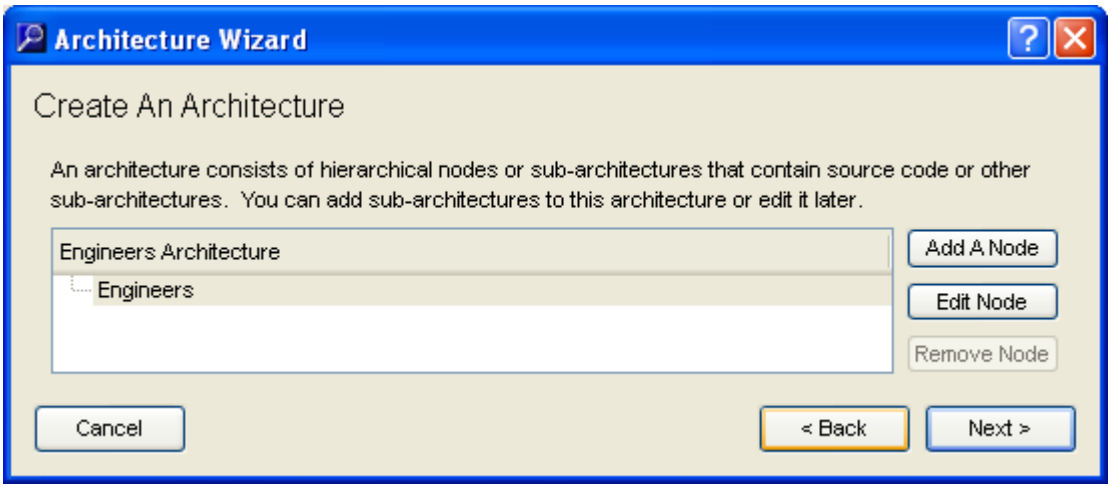
Using the Architecture Wizard

When you open the Architecture Wizard by choosing **Architect-> New Architecture** from the menus or clicking the icon in the Architect Manager window, you see a page that asks for the name of your architecture.

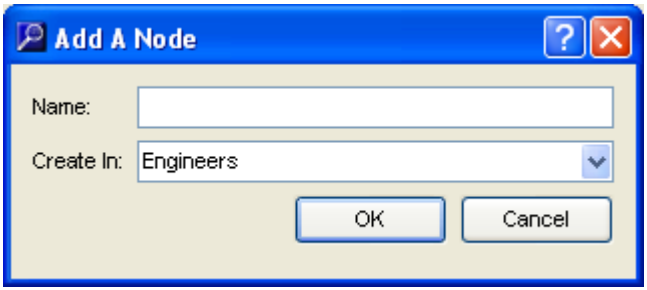

Architecture Wizard
Create An Architecture
An architecture is an abstract hierarchy layered onto a body of source code.
For example, a staff architecture could list which engineers worked on a particular project and each engineer would contain a list of source code belonging to them. Dependencies and other useful information can then be derived from the architecture. First, you need to give the architecture a name.
Enter a name for the architecture:
Cancel
< Back
Next >

Type a name for the architecture. This name should be fairly short so it can be shown in architecture trees.

Then click **Next** to see the page that lets you add and edit architecture nodes. This is the hierarchy to which entities will be assigned in a later page of the wizard


Architecture Wizard
Create An Architecture
An architecture consists of hierarchical nodes or sub-architectures that contain source code or other sub-architectures. You can add sub-architectures to this architecture or edit it later.
Engineers Architecture
Engineers
Add A Node
Edit Node
Remove Node
Cancel
< Back
Next >

Click **Add a Node** and type the **Name** of the node you want to add. The default location is within the node you had selected in the Architecture Wizard, but you can select another location in the **Create In** field. Then click **OK**.



You can modify nodes you have created by selecting a node and clicking **Edit Node**. You can delete the selected node by clicking **Remove Node**.

The next window presents an animation that shows how to use the Architecture Editor to add entities to the nodes you have created. When you have finished watching the animation, click **Finish**. This opens the Architecture Editor shown in the animation. Your architecture nodes are shown on the right. See *Editing an Architecture* on page 7–12 for details on adding entities to each node.

Editing an Architecture

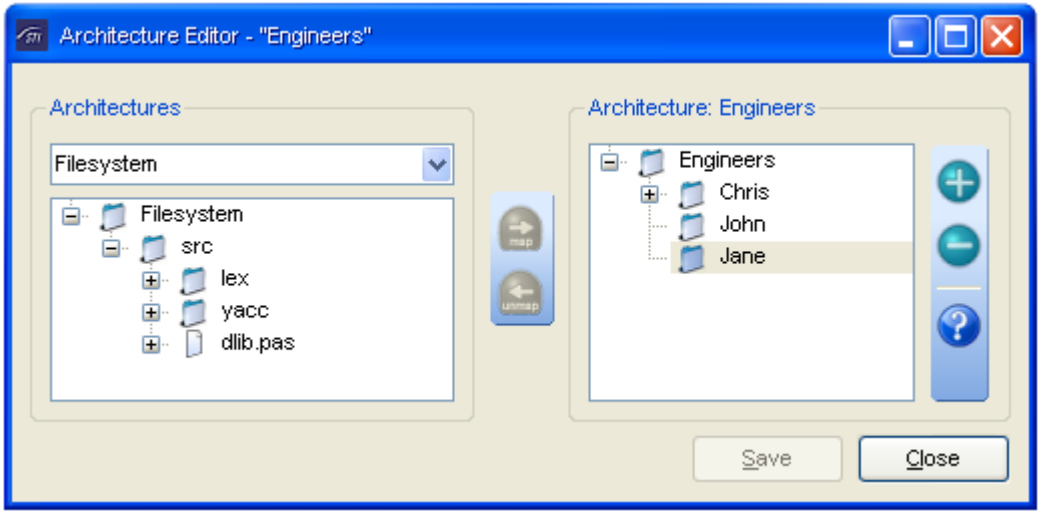
To edit an existing architecture, select that architecture and click the icon in the Architect Manager window. Or, right-click on an existing architecture and choose **Edit Architecture** from the right-click menu. Both actions open the Architecture Editor.

This dialog allows you to manually create architectures. You create an architecture structure on the right-hand side and map entities into the architecture from the left-hand side.

You can transfer items between the two sides only if there is a selection on both the left and right sides.

To use the Architecture Editor, follow these steps:

1 You can double-click on the name of any node on the right side of the Architecture Editor and rename that node by typing.



2 Select one or more entities on the left side of this dialog. Begin by selecting an existing architecture to use to find entities. Then, expand the tree and select the highest-level entity that you would like to copy to your new architecture. For example, you can select files or functions.

3 On the right side of the Architecture Editor, select the node that should contain the nodes you are copying.

4 Click the "Map" right arrow between the two sides to copy a node and its sub-nodes to your custom architecture. The entities are copied to the selected node. When you copy an entity within a file, the tree hierarchy to get from the file to that entity is also copied.

5 Click the "Unmap" left arrow between the two sides to delete the selected node and its sub-nodes from your custom architecture.

6 You can use the icons on the right side of the editor to add (+) and delete (-) nodes. Click the ? icon to watch an animation that shows the steps for adding entities to nodes. (As always, right-click on any node to use its right-click menu.)

7 When you finish editing your custom architecture, click **Save**.

Using XML to Manage Architectures

You can use XML as a way to share architectures between one *Understand 2.0* database and another.

In addition to using XML to share architectures, you can use XML export/import to quickly create architectures that are a simple subset of another architecture by selecting a lower node in the hierarchy.

Exporting Architectures to XML

To create an XML file for an architecture, follow these steps:

1. Select the highest-level node of the architecture that you want to export. All of the hierarchy below the node you select will be represented in the XML file.
2. Click the icon in the Architect Manager window. Or, right-click on the node you selected and choose **XML Export** from the right-click menu.
3. You see an XML file that contains <arch> and <set> tags for architecture nodes.
4. When you close the XML window, you are asked if you want to save the file. If you click **Save**, the default filename is the name of the node you selected.

Importing XML Architectures

To import an XML file for an architecture, follow these steps:

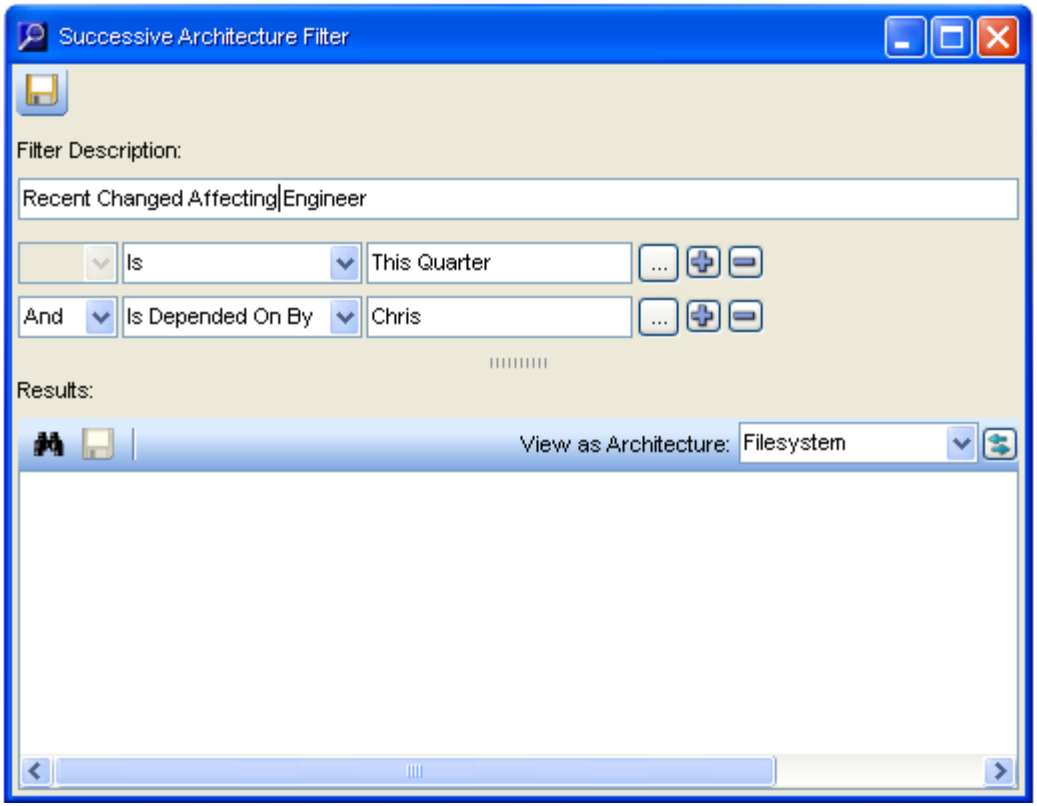
1. Click the icon in the Architect Manager window.
2. In the Choose XML File to Import Architecture dialog, select an XML file that matches the tag format used by *Understand 2.0* to describe architectures. For example, you can choose XML files created by *Understand 2.0*. Click **Open**.
3. The architecture described by the XML file is added to your list of architectures.

Using Architecture Filters

Architecture filtering allows you to find a subset of code in which you are interested.

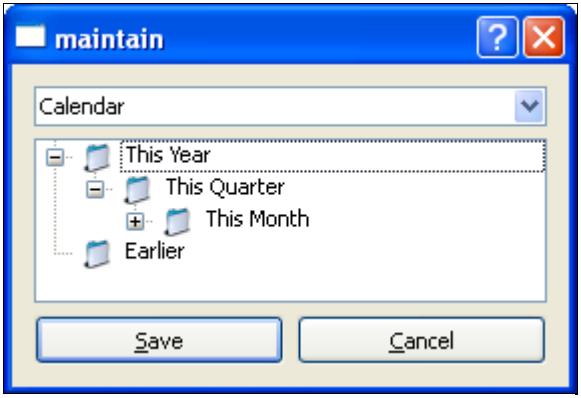
A powerful way to use architectures is to combine them through successive filtering. For example, you can use successive filters to find code that depends upon code that was changed this month. Or, you can combine custom functional decomposition and staff architectures to find out who modified entities in the “3Ddisplay” portion of a project.

Successive filters are saved as dynamic architectures. That is, they store the parameters used for the filter so that, as the database changes, the filter continuously updates.

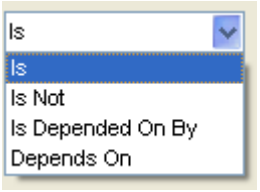


To use successive filtering, choose **Architect->Filter Architectures** from the menubar in the main *Understand 2.0* window. Then, use the Successive Architecture Filter window by following these steps:

1. Type a **Filter Description** for the filter you intend to create. This is a text description—it can be longer than the name you will save the filter with.
2. Click the "**...**" button in the row below the Filter Description. You see a window similar to the following:



3. In the top field, select a defined architecture. For example, in the figure above, the "Calendar" architecture was selected.
4. In the list of architecture nodes, select the node you want to filter based on. Then click **Save**. This places the name of the node you selected in the first row of the Successive Architecture Filter window.
5. In the field to the left of the node you selected, choose how you want the filter to compare entities. The default is "Is", but you can select "Is Not", "Depends On" or "Is Depended On By".



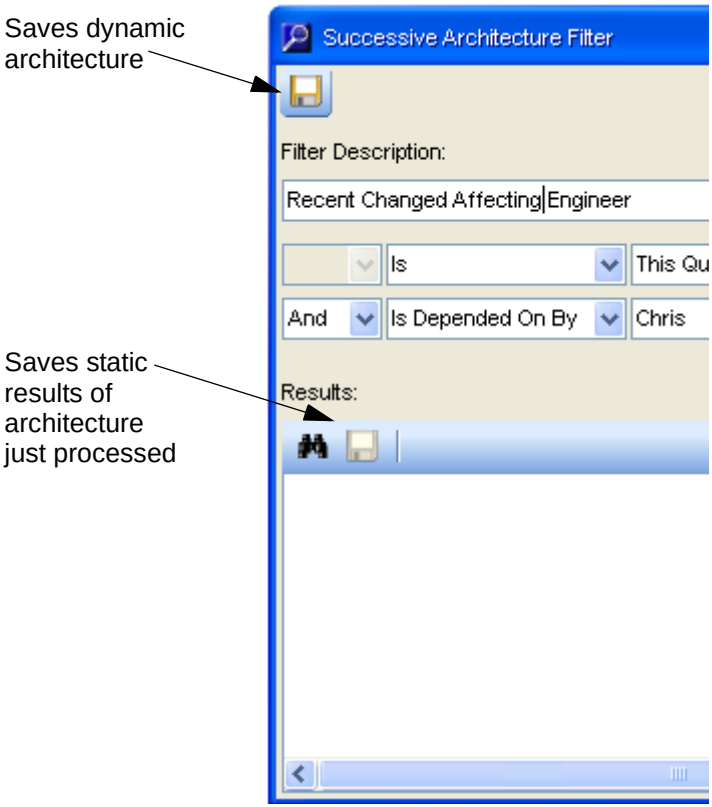
   "Depends On" means all the code that the selected architecture depends upon. For example, if you select "This Month" and "Is Depended On By", the result of the filter is any code that depends upon code that was changed this month.
6. After you have set up one filter line, you can add another line by clicking the "+" button. Then, fill in the new line by repeating steps 2 through 5. For lines other than line 1, you can also choose whether the filters should be ANDed or ORed with the previous filter. To remove a filter line, click the line's "-" button.
7. To see the results of your current filter combination, click the binocular icon.

8 You can change the hierarchy used to display the results of your filter using the View as Architecture field and clicking the arrow button.

9 To save your filter combination as a new *dynamic* architecture, click the disk icon at the top of the window and enter a name for the filter.

In contrast to the top save icon button, the lower save icon saves the results of the filter as a *static* architecture. The results of a static architecture are not updated when the database is updated.

For example, if your filter finds files changed within a certain time period, those results will be updated with newly changed files and the new date when you use a dynamic architecture again. In contrast, a static architecture would save the results as of the time you created that architecture.



Chapter 8 Managing Source Changes

This chapter is explains the change-management features provided by *Understand 2.0* and explains how you can use snapshots to analyze changes to your code.

This chapter contains the following sections:

Section	Page
About Snapshots	8–2
Managing Snapshots	8–2
Comparing Snapshots	8–6
Exploring Changes	8–9
Using Change Reports	8–15
Comparing Entities	8–17
Comparing Files and Folders	8–20
Using TrackBack	8–23

About Snapshots

A snapshot captures the state of the files and entities in your project at a given point in time. Snapshots allow you to compare changes between entities as they were at different times.

An *Understand 2.0* snapshot stores all the information needed to regenerate metrics, reports, change markups, and more based on the state of your source code when you created the snapshot. (Creating frequent snapshots or snapshots of large code projects can result in very large .udb project files.)

One of the advantages of using *Understand 2.0* to find differences between snapshots is that the snapshots you save are always accessible in the database. You don't need to do large checkouts of old source code in order to make comparisons.

If you want to create snapshots of older generations of your source code (from before you used *Understand 2.0*), you can check those versions out in order to make snapshots of old code.

Managing Snapshots

You use the Snapshots window to manage snapshots. You can create, edit, and delete snapshots.

To open this window, choose **Change->Manage Snapshots** from the main menubar in *Understand 2.0*.

In this window, each snapshot has its own column listing project metrics for each language used in the project.

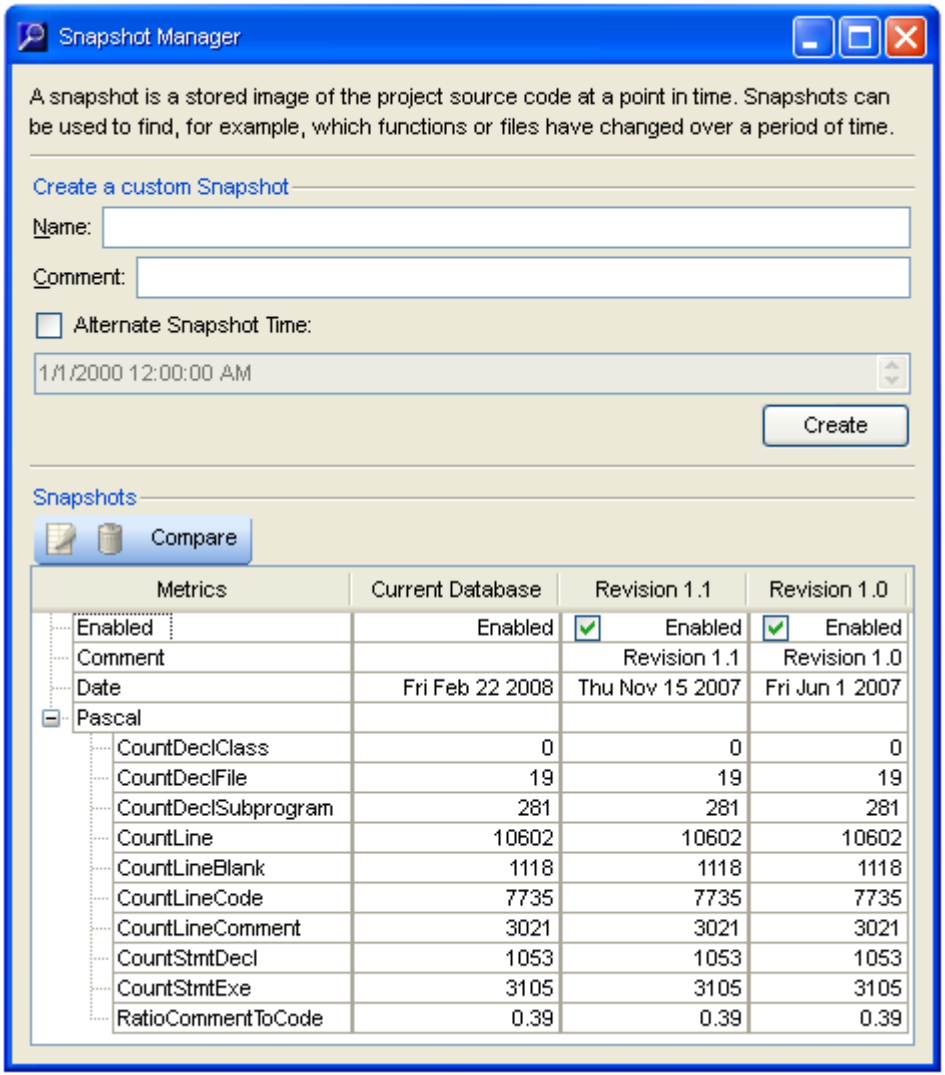
Columns are sorted left-to-right from newest to oldest snapshot. There is also a column for the "Current Database"; this is not technically a snapshot, since it isn't saved for future reference.

Unlike the *TrackBack* tool you might have used, *Understand 2.0* compares whole-project snapshots you have saved—not changes to individual files that are backed up as they happen or on a regular schedule.

Creating a Snapshot

When you create a snapshot, you can give it a name, comment, and a creation date. To create a snapshot, follow these steps:

1 Choose **Change->Manage Snapshots** from the main menubar in *Understand 2.0*.



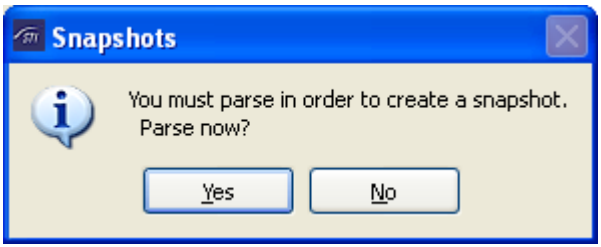
2 Type a **Name** for the snapshot. This should be short enough to fit in drop-down fields and as a column heading.

3 Optionally, type a **Comment** for the snapshot you will create. This can be longer than the snapshot name.

4 Optionally, check the **Alternate Snapshot Time** box and type a date and time for the snapshot. The default is the current time, and you can keep this default if you are creating a snapshot of the current state of the codebase. If you are creating a snapshot of an older version of the codebase—for example, files that have been retrieved from a code management system—you may want to modify the date to match when the files you are snapshotting were created.

5 Click **Create**.

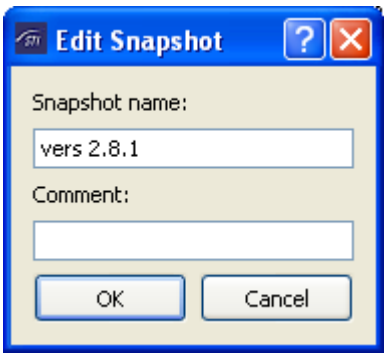
6 You may be told that you must parse your code in order to create a snapshot. Click **OK** if you want to analyze your project and create a snapshot.



7 When the snapshot has been created, the new snapshot has its own column in the Snapshot Manager window.

Edit Snapshot

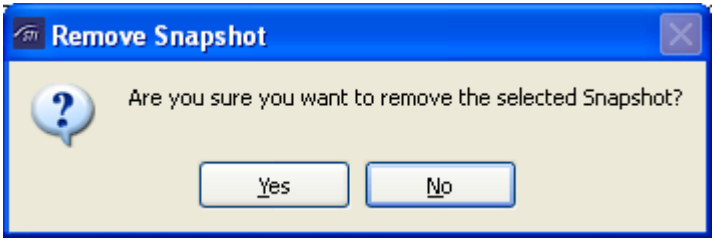
In the Snapshots window, click the **Edit** icon to open the Edit Snapshot window.



You can modify the name or comment for a snapshot. If you want to modify anything else about a snapshot (such as the date), you can delete and recreate the snapshot.

Remove Snapshot

If you want to delete a snapshot, select the column for the snapshot you want to delete in the Snapshots window, then click the **Remove** icon.



Removing a snapshot removes the information in the *Understand 2.0* database. It does not remove the actual files on which the snapshot is based.

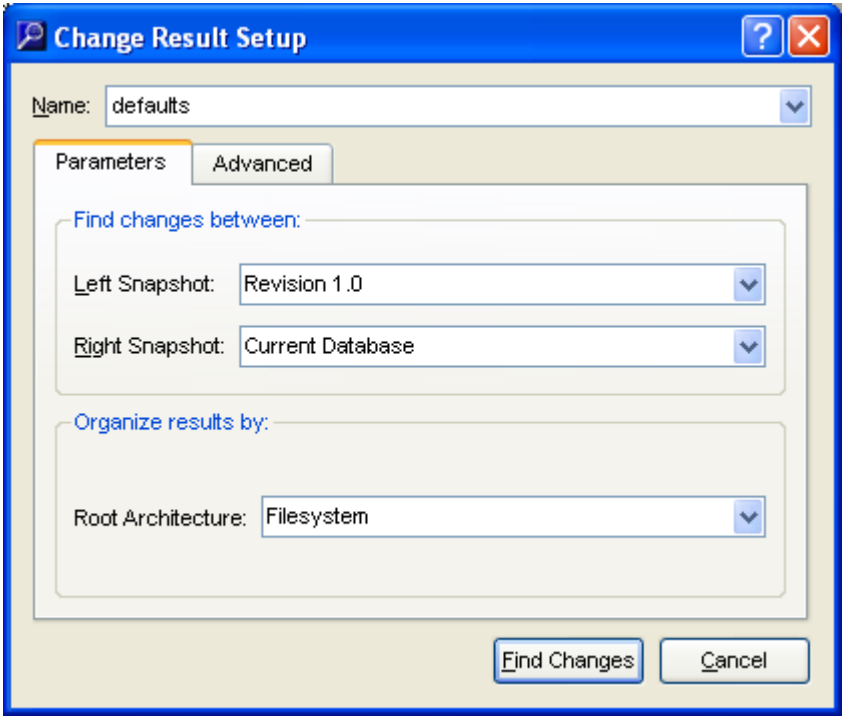
(If removing a snapshot creates enough empty space in the *Understand 2.0* database, the database will be compacted automatically.)

Comparing Snapshots

To compare snapshots you have taken of your project with the current state of your project, you can compare snapshots and explore the differences.

To compare snapshots, follow these steps:

1 Choose **Change->Compare Snapshots** from the main menubar in *Understand 2.0*. This opens the Change Result Setup dialog:

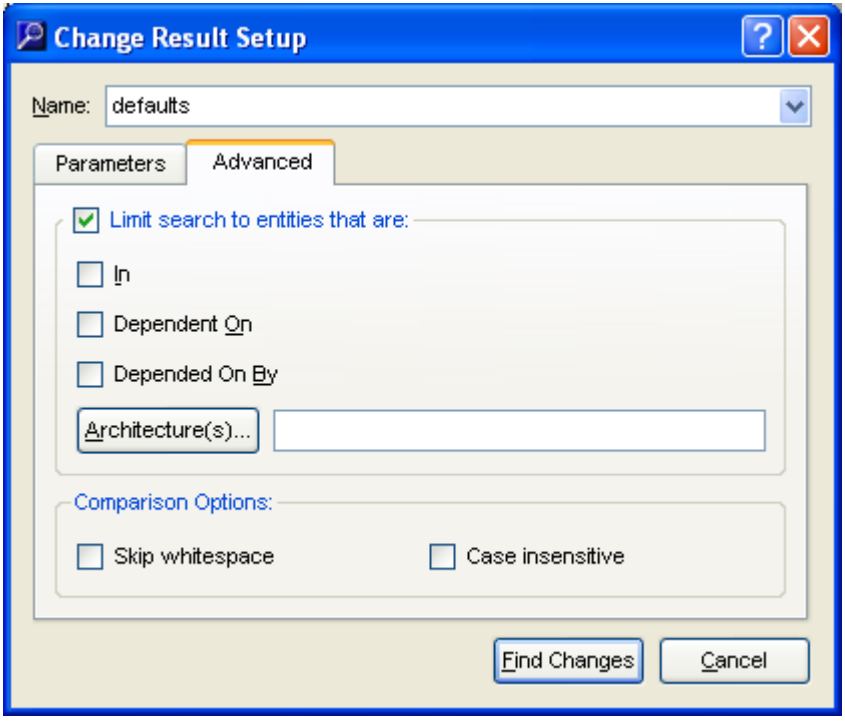


2 In the **Left Snapshot** field, select the snapshot version you want to compare to a later version.

3 In the **Right Snapshot** field, select the snapshot version you want to compare to an earlier version. This field lists only snapshots with dates later than the current Left Snapshot.

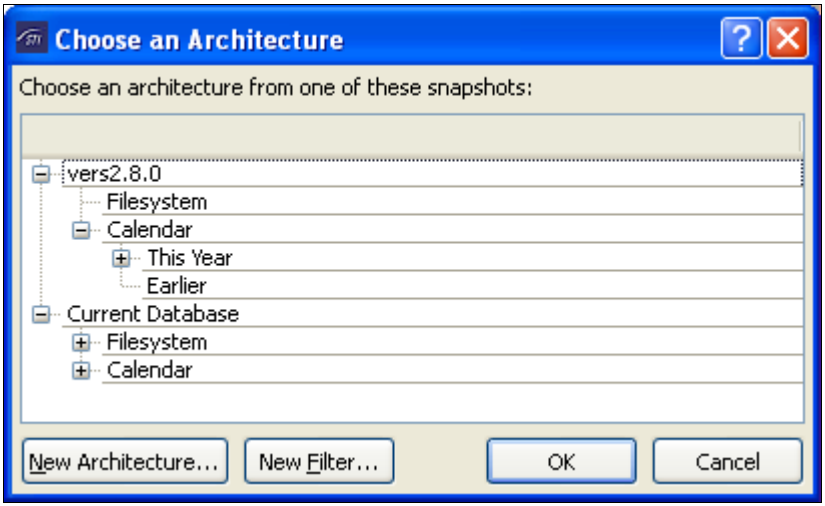
4 You can use architectures (see Chapter 7) to organized the results. To do this, select a **Root Architecture** from the list.

5 If you want to further control how the architecture is used, move to the **Advanced** tab and follow the steps below.



- In the Advanced tab, put a check in the **Limit search to entities that are** field.
- Choose whether you want to see changed entities that are in, depend upon, and/or are depended on by an architecture node. Note that you can select more than one option here.

- Click the **Architecture(s)** button. You will see the Choose an Architecture window:



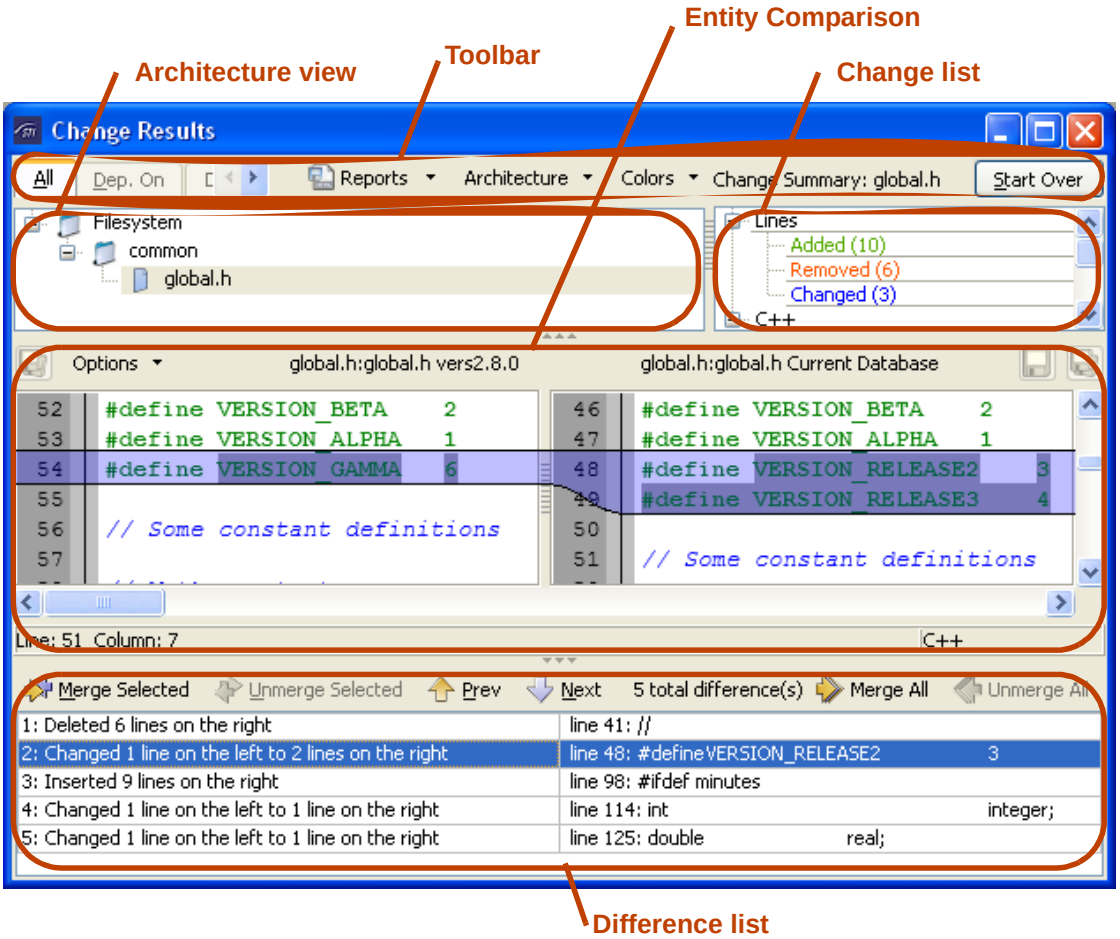
- Expand a snapshot to see its architectures and the architectures nodes. Select an architecture or node and click **OK**.
- If you want to create a custom architecture, click **New Architecture** (and see page 7–12) or **New Filter** (and see page 7–15).

6 In the **Comparison Options** area of the Advanced tab, you can choose to **Skip whitespace** or do a **Case insensitive** search. These options are possible in *Understand 2.0* because it compares entities and syntax rather than comparing files character-by-character as many differencing tools do.

7 Click **Find Changes** to compare the snapshots.

Exploring Changes

When you compare snapshots to generate change results, you see a Change Results window:



This window provides several ways to examine the difference results you created. The window has these main areas:

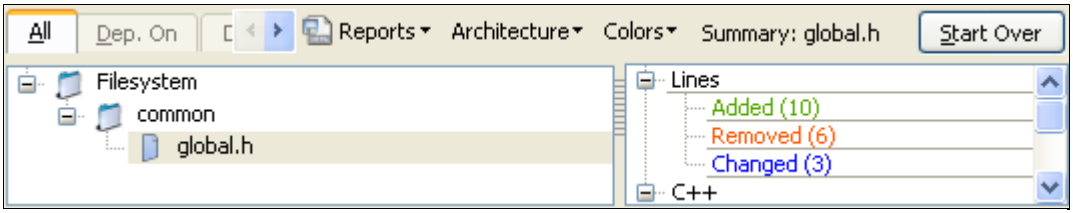
- **Architecture view.** This area lists entities that were changed using the selected architecture hierarchy. See page 8–10.
- **Change list.** This area shows how many changes there are within the selected hierarchy node or entity. The number of changes is also provided individually for each source language in the project. See page 8–11.

- **Entity Comparison.** This area allows you to examine the differences in entity versions. See page 8–11.
- **Difference Listing.** This area allows you to select individual differences between two versions. See page 8–14.
- **Toolbar.** This allows you to modify how the Architecture view area is displayed (see page 8–10). You also use it to generate reports based on changes (see page 8–15).

The small fold icon between the areas allows you to close and reopen areas to make more space for the other areas.

Architecture View

The architecture view portion of the Change Results window lists entities that were changed using the selected architecture hierarchy. You can use the toolbar to adjust how these entities are listed.

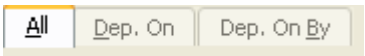


Expand the architecture to find the changed entities. When you select an entity, the number of changes made to it is shown in the Change List (page 8–11).

By default, the results are organized according to the **Root Architecture** field in the Change Result Setup window. You can change the organization by using the Architecture drop-down in the toolbar to select a different architecture.

Entities that were added or deleted are shown in different colors. You can change these colors using the Colors drop-down in the toolbar.

If you chose to limit the search using an architecture node, you can select the **All**, **Dep. On**, and **Dep. On By** tabs in the toolbar.



As always, right-click on any hierarchy node or entity to see lots of item-specific options in the right-click menu.

You can double-click an entity to open the most recent source file containing its definition in a source editing window.

Change List

This area shows how many changes there are within the selected hierarchy node or entity. Select a different hierarchy node or entity to see how many changes there are at each level.

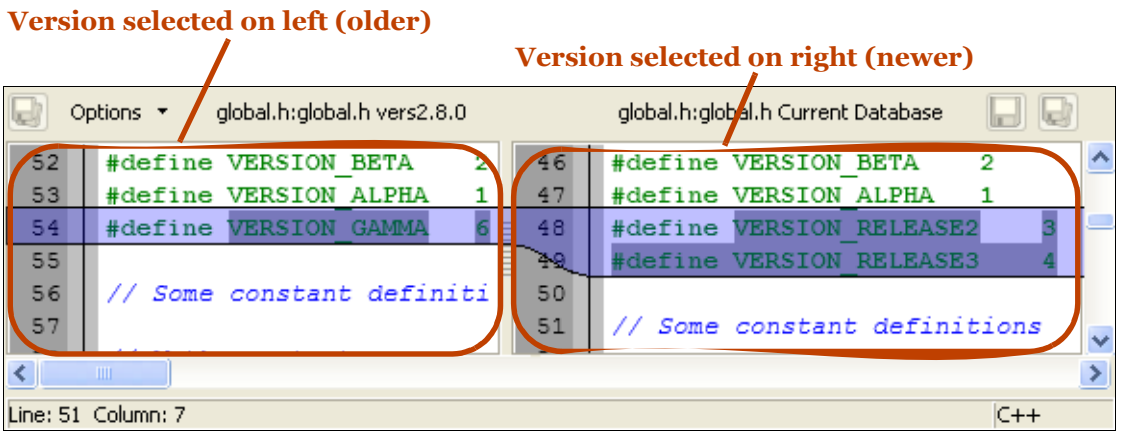
The Change Summary above the list shows the name of the item selected.

Line additions, deletions, and changes are shown in different colors. You can change these colors using the Colors drop-down in the toolbar.

The number of changes is also provided individually for each source language in the project.

Entity Comparison

The Entity Comparison area shows individual differences between versions of an entity. The display is similar to that of common differencing tools.



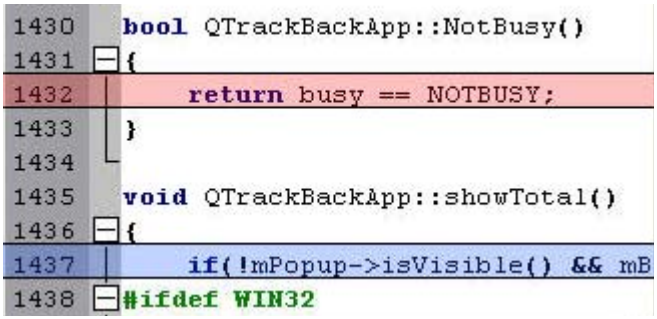
The left side shows the older snapshot of the entity; the right side shows the newer snapshot. The snapshot version names are shown just above the listings.

The two listings automatically jump to the first difference. Scrolling of the two listing is synchronized horizontally and vertically.

For certain languages that *Understand 2.0* understands—such as C code—you can click the + and - signs in the listings to expand and compress code constructs such as if and else statements, functions, extended comments, and so on.

Line-by-line differences are shown in the colors in the toolbar's Colors drop-down.

The currently selected difference is highlighted in blue (or bluish purple on some screens) by default. Other differences are highlighted in pink by default.



You can edit the source code if you like in the current database version of the files. However, you cannot save changes in the Change Results window.

You can select text and copy it to the clipboard. To select text, use the mouse or your keyboard. To select all, press Ctrl+A or right-click and choose **Select All**. To copy text to the clipboard, press Ctrl+C or right-click and choose **Copy**.

To search for text in the source code displayed, follow these steps:

1 Press Ctrl+F to display the Search area in place of the status bar.

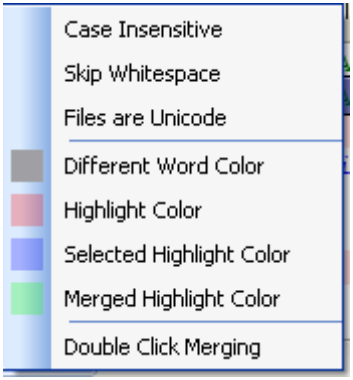
2 Click on the left or right listing to select which one to search. The default is the right listing unless you clicked the left one more recently.

3 Type the text you want to search for in the search field. The listing automatically moves to the next occurrence of that text as you type. The two listings scroll together.

4 You can put checkmarks in the **Match case** or **Match whole words** boxes to specify how the search is performed.

5 Click **Next** or **Previous** to search down or up. If you want to search the other listing, click there.

You can use the Options drop-down to display the following options:



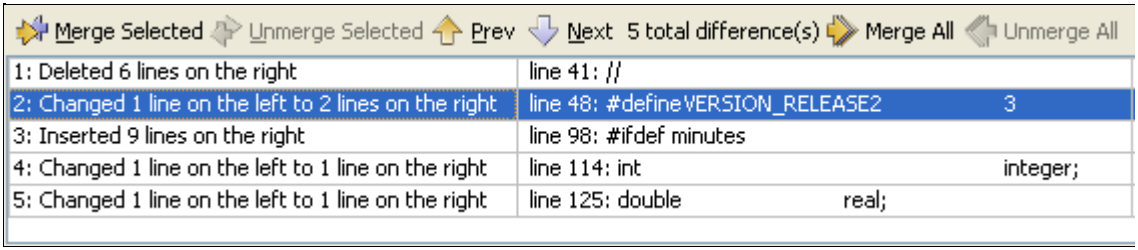
- **Options->Case Insensitive.** By default, changing the case of a letter is not treated as a difference. For example, if you change “a” to “A”, the Difference Listing shows “No Differences” if that was the only change.
- **Options->Skip Whitespace.** By default, changing the number of spaces or tabs is not treated as a difference. The Difference Listing shows “No Differences” if only whitespace was changed. You can change this behavior by toggling this option off.
- **Options->Files are Unicode**. By default, differences are reported only for ASCII files. If *Understand 2.0* says “File is Binary”, use this command to turn on Unicode file handling.
- **Color choices.** These options let you change the highlighting in the entity comparisons.
- **Double Click Merging.** A shortcut for merging is to double-click on a difference in the listing. This works only if you enable it here.

The Case Insensitive, Skip Whitespace, and Files are Unicode options are not available if you have made a change to a listing.

The status bar shows your line location in the source code where you last clicked. It also shows the language of the code.

Difference Listing

The Difference listing area shows a list of the changes in the entity currently shown in the Entity Comparison area.


Merge Selected
Unmerge Selected
Prev
Next
5 total difference(s)
Merge All
Unmerge All
1: Deleted 6 lines on the right
line 41: //
2: Changed 1 line on the left to 2 lines on the right
line 48: #define VERSION_RELEASE2 3
3: Inserted 9 lines on the right
line 98: #ifdef minutes
4: Changed 1 line on the left to 1 line on the right
line 114: int integer;
5: Changed 1 line on the left to 1 line on the right
line 125: double real;

You can click the Prev and Next buttons above the Entity Comparison area to jump to another difference between the entities.

You can merge changes made in older versions into the most recent version of an entity. (You cannot merge changes into an older version.) However, you cannot save merged changes within the Change Results window—you can copy and paste merged changed into another application. To merge changes, follow these steps:

1. Use the Architecture view to select which entity to display.
2. Select a difference in the listings or by selecting a line in the Difference listing area.
3. Click the **Merge Selected** button. This copies the older (left) version of this difference to the current (right) version of the code. (If you change your mind, click **Unmerge Selected**.)
4. Click the **Prev** or **Next** button to move to another difference and repeat the previous step.
5. When you have finished making changes, you can right-click and choose **Select All** and press Ctrl+C. Then, paste the merged file into a Source Editor window or another application.

In the difference list, merged differences are shown in italics. In the listings, differences you have merged are highlighted in green. (The currently selected difference is still highlighted in blue/purple, even if it has been merged.)

A shortcut for merging is to double-click on a difference in the listing if you have enabled **Double Click Merging** in the Options drop-down.

If you know you want to merge all of the differences, click **Merge All**. If you want to undo all merges you have made, click **Unmerge All**.

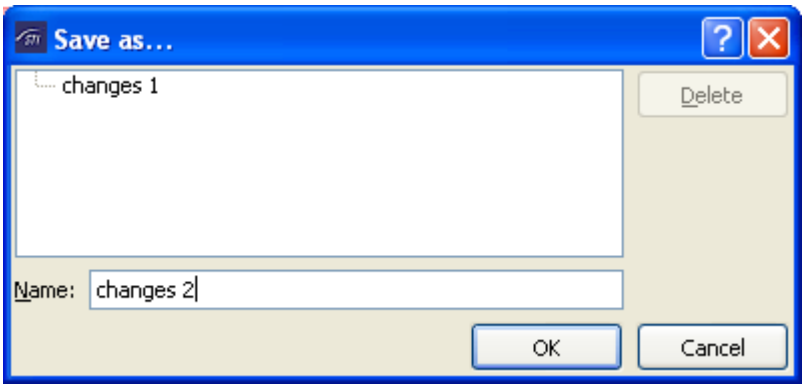
Using Change Reports

You can generate HTML reports that are equivalent to the change results available in the Change Results window. Many pages are created, so you can browse the results in various ways.

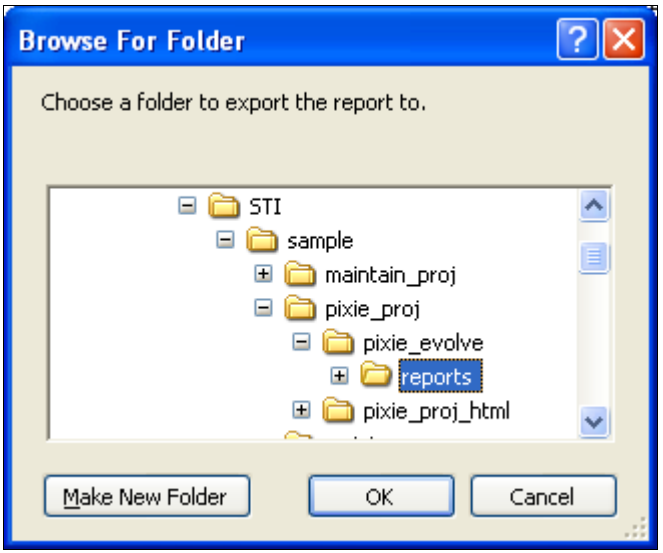
To generate a report, follow these steps:

1 From the Change Results window toolbar, choose **Reports-> Generate Reports**.

2 You are asked to name your report. Type a name and click **OK**. The Save As dialog lists any other reports you have already created.



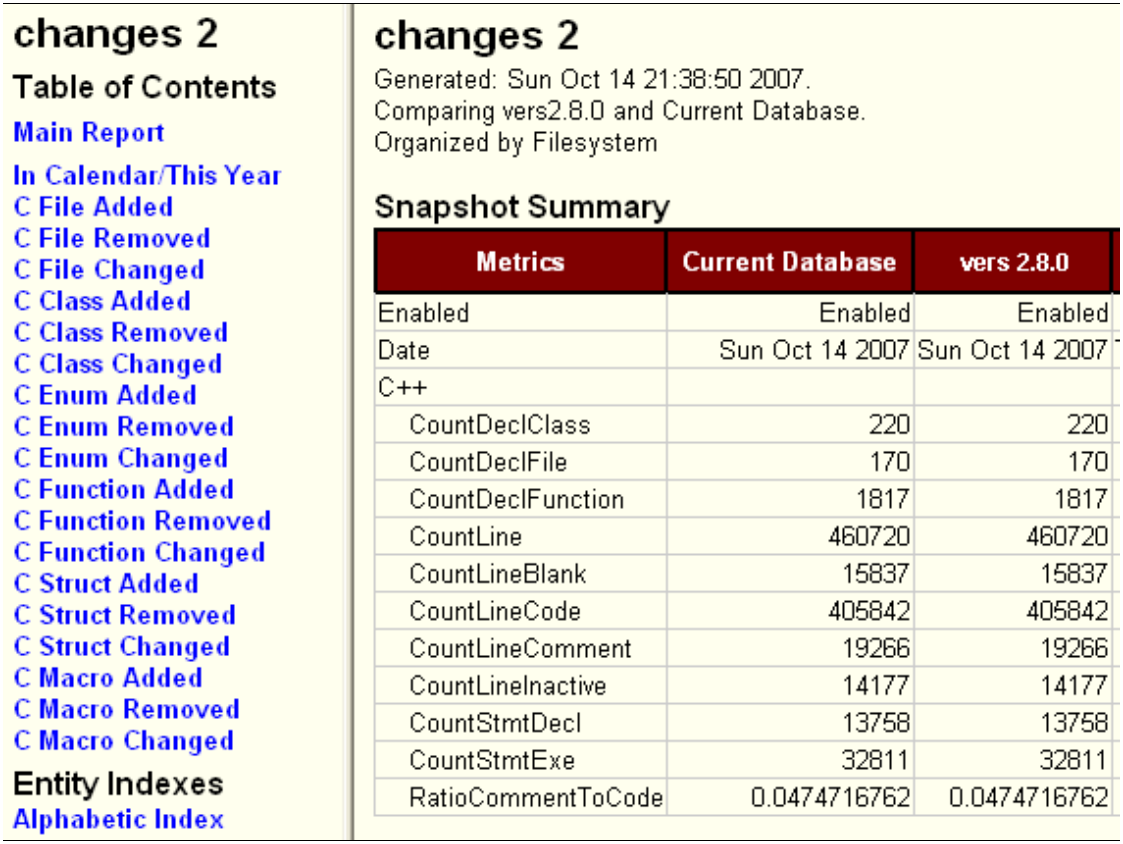
3 In the Browse For Folder dialog, browse to the location where you want to store your report.



4 Unless you already have an empty folder to contain your report, click **Make New Folder**. Rename the new folder to the name you want. Then click **OK**.

5 Dialogs show the progress of the report generation.

6 When the report generation is complete, choose **Reports-> View Report** from the Change Results window toolbar.



changes 2

Table of Contents

Main Report

In Calendar/This Year
C File Added
C File Removed
C File Changed
C Class Added
C Class Removed
C Class Changed
C Enum Added
C Enum Removed
C Enum Changed
C Function Added
C Function Removed
C Function Changed
C Struct Added
C Struct Removed
C Struct Changed
C Macro Added
C Macro Removed
C Macro Changed

Entity Indexes
Alphabetic Index

changes 2

Generated: Sun Oct 14 21:38:50 2007.
Comparing vers2.8.0 and Current Database.
Organized by Filesystem

Snapshot Summary

Metrics	Current Database	vers 2.8.0
Enabled	Enabled	Enabled
Date	Sun Oct 14 2007	Sun Oct 14 2007
C++		
CountDeclClass	220	220
CountDeclFile	170	170
CountDeclFunction	1817	1817
CountLine	460720	460720
CountLineBlank	15837	15837
CountLineCode	405842	405842
CountLineComment	19266	19266
CountLineInactive	14177	14177
CountStmtDecl	13758	13758
CountStmtExe	32811	32811
RatioCommentToCode	0.0474716762	0.0474716762

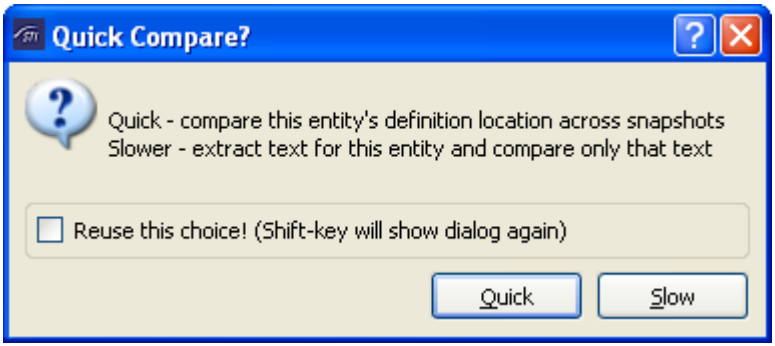
- The Main Report pages shows metrics for all the saved snapshots and the current project.
- The next page shows the Architecture view hierarchy.
- Depending on the languages used in your project, pages for various types of entities are included. For each entity type, there is a page listing items added, removed, and changed.
- When you click on a filename, a page showing the entity comparison for that file is shown.
- Finally, an alphabetic index of changed files and entities is provided.

Comparing Entities

There are two ways to compare entities in *Understand 2.0*. You can compare an entity across different snapshots, or you can compare one entity with another.

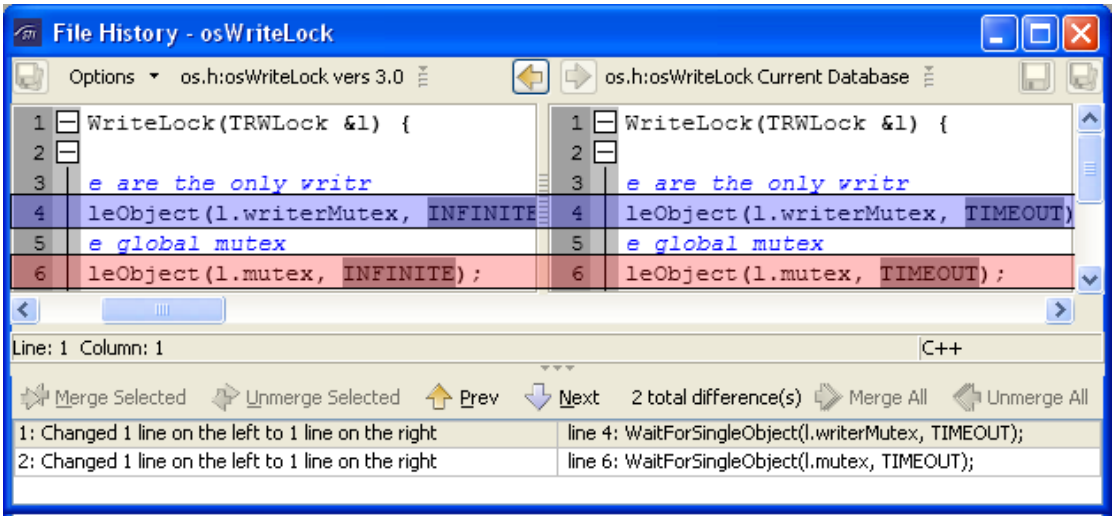
Comparing Entities Between Snapshots

When you right-click on an entity in *Understand 2.0*, the right-click menu often contains the **Compare** command. When you choose this command, you see the following question:


Quick Compare?
Quick - compare this entity's definition location across snapshots
Slower - extract text for this entity and compare only that text
Reuse this choice! (Shift-key will show dialog again)
Quick
Slow

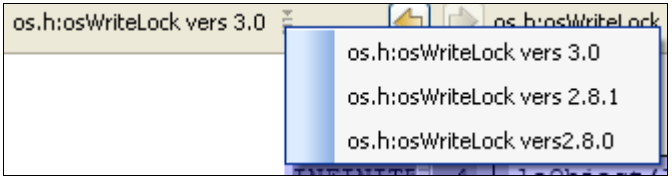
- If you choose **Quick**, whatever is at the entity's current definition location in previous snapshots is compared with the entity's current definition. For example, if an entity definition is on lines 25 to 35 of the main.c file, then those lines are compared across snapshots.
- If you choose **Slow**, then the definitions for the entity in each snapshot are compared.

The comparison window looks similar to this:



As you can see, this window is similar to the Change Results window, except that the Architecture view hierarchy is omitted. (This is because the comparison is for one file or entity only.)

This window allows you to move through various snapshots to view the sequence of changes to a particular entity. To change the version viewed, click the drop-down icon for the left or right code to see a list of the versions available:

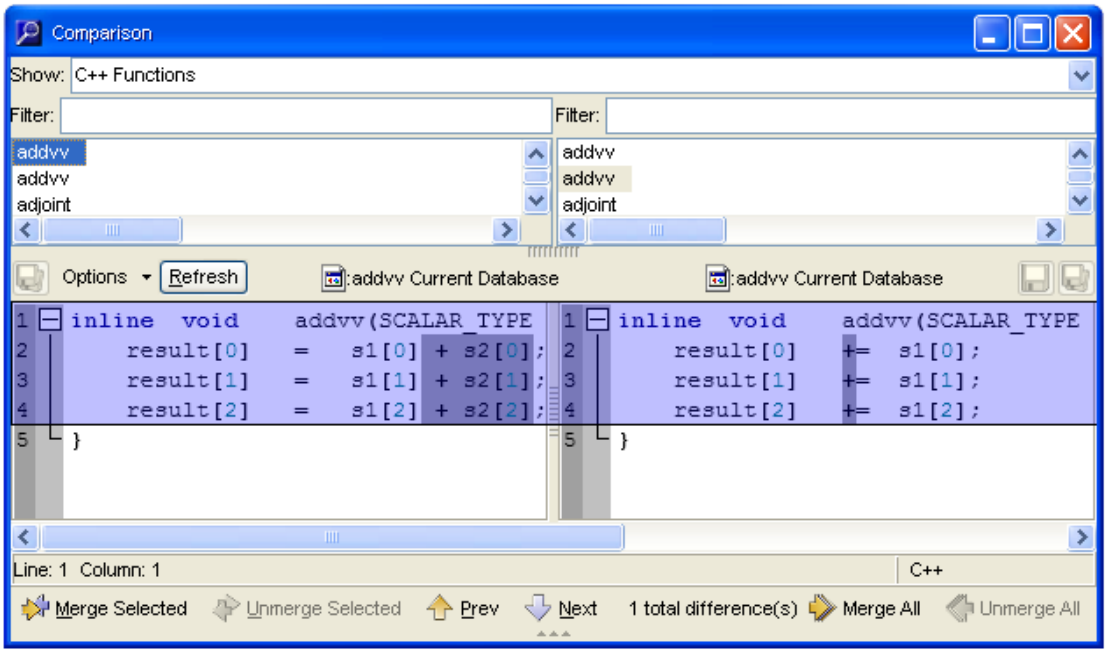


You can move backward and forward through the history of a file's snapshots by clicking the left and right arrows.

The version you select on the left must have an earlier date than the version on the right.

Comparing Two Entities

You can compare two entities by choosing **Change->Compare Entities** from the menus. You see the Comparison window.

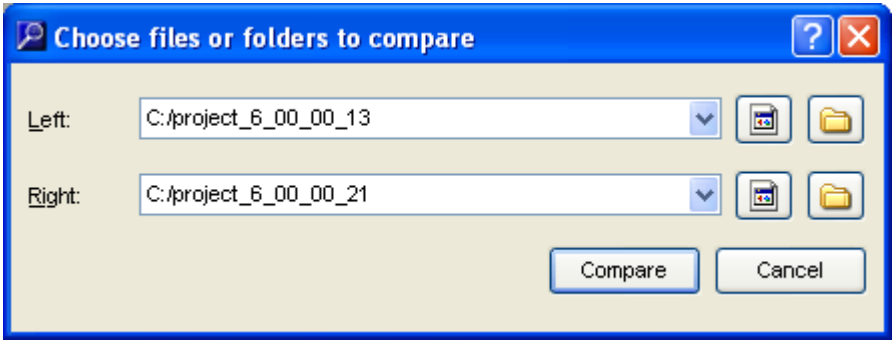


This window behaves similarly to other comparison windows. At the top of the window is an entity filter (page 4–5). Select a type of entity. Then use the lists to select two entities you want to compare.

You cannot save merged changes in this window.

Comparing Files and Folders

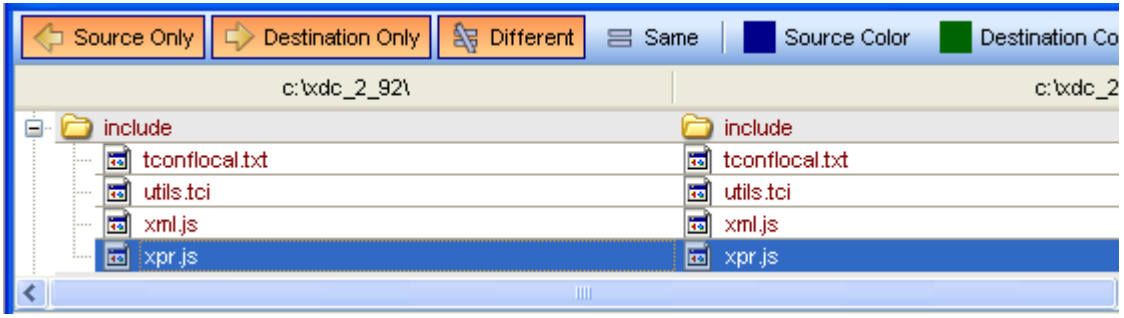
Understand 2.0 provides a tool for comparing files and folders. To open this tool, choose **Change->Compare files/folders** from the menus.



In this dialog, select a file or folder for the left and right comparison. Both sides should be similar files or similar folders. Click the file icon to browse for a file; click the folder icon to browse for a directory.

Subdirectories of the directories you choose are also compared.

In the directory comparison, you can use the icons at the top to view the directory tree with only different files, unchanged files, or both changed and unchanged files.



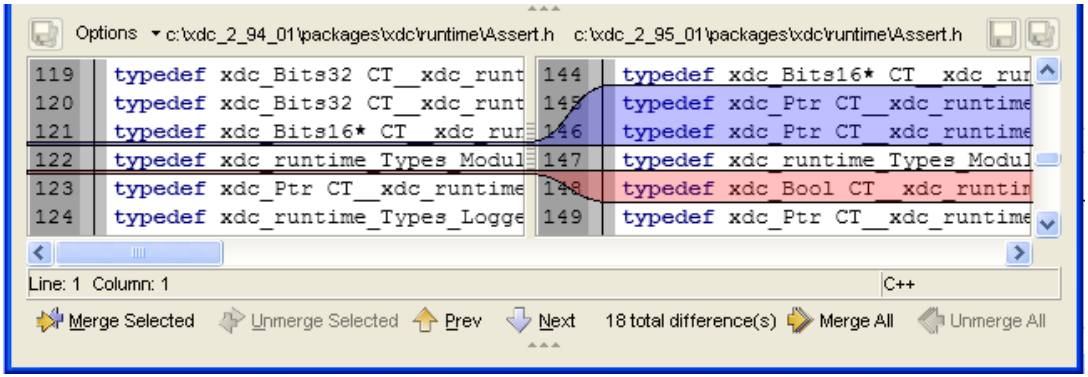
Toggling the **Source Only** icon on causes the list to show files that were in the source (left) version but not in the destination (right) version. Toggling the **Destination Only** icon causes the list to show files that exist in the destination version but not in the source version. You can have both choices toggled on at the same time.

Toggling the **Different** icon on causes the list to show files and directories that are different in the two versions. Toggling the **Same**

icon on causes the list to show files and directories that have not changed. You can show both different and same items at the same time.

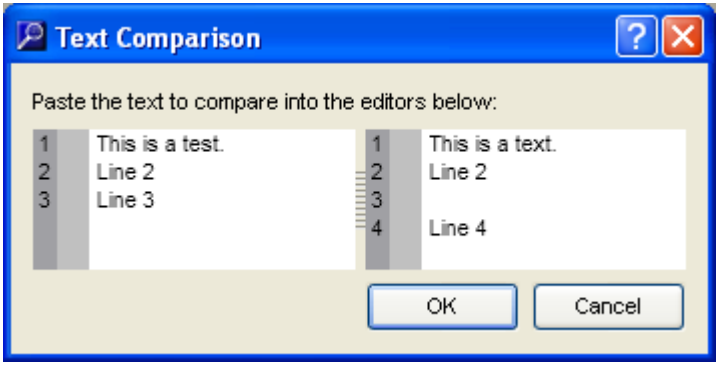
If you click any of the three color blocks, you can change the color for items only in the source (left version), items only in the destination (right version), or items that exist in both versions but were changed.

The file comparison is similar to the comparison between two snapshots or two entities. You can merge and unmerge changes, but cannot save files.

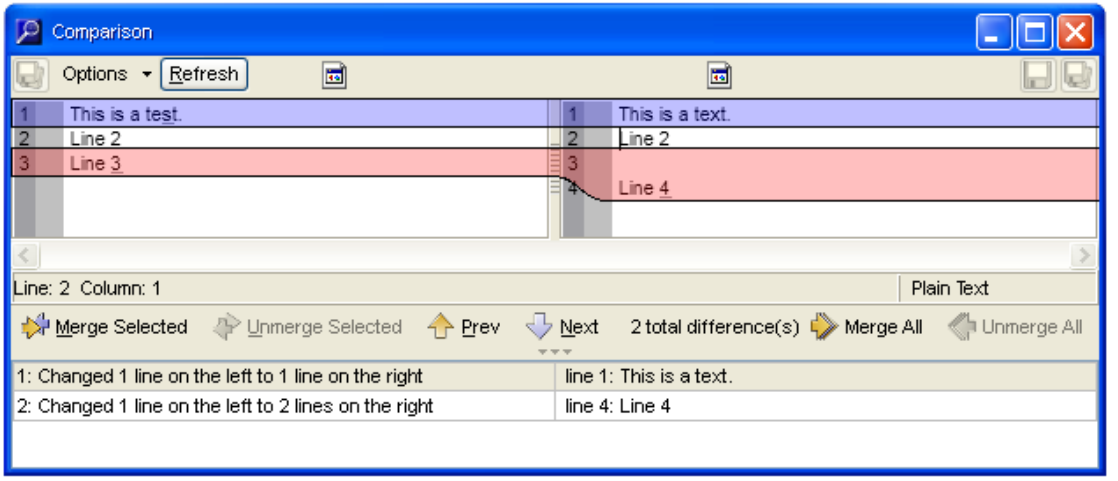


Comparing Text

You can compare text that you paste into a window by choosing **Change->Compare arbitrary text** from the menus. You see a window like this:



Paste the before and after text you want to compare into the left and right sides. Then, click **OK** to see the comparison.



The text comparison is similar to the comparison between two snapshots or two entities. You can merge and unmerge changes, but cannot save files.

Click the **Refresh** button if needed to see the comparison highlighting.

Click the fold icon to see a list of differences.

Using TrackBack

The *TrackBack* tool automatically tracks changes to files. These changes are backed up as they happen or on a regular schedule.

By default, *TrackBack* is installed with *Understand 2.0* and integration is enabled. To change the *TrackBack* integration setting, see page 3–52.

TrackBack is a “personal change management” tool that automatically creates backup versions of important files and directories. It fills the gap between application-specific “autosave” functions and expensive enterprise-wide change management software, providing new power and productivity to individuals.

You can launch *TrackBack* from within *Understand 2.0* by choosing **Tools->TrackBack History Explorer** from the menus. For details about using *TrackBack*, see the *TrackBack User’s Guide.*

When a Source Editor window is active, you can use the following icons in the toolbar for *TrackBack* integration:

Add the current file to the set of files tracked by *TrackBack*. This icon is inactive if the current file is already being tracked.

Open *TrackBack* to view the history of the current file. This icon is inactive if the current file is not being tracked by *TrackBack*. You can also right-click on a file that is being tracked and choose **TrackBack file history**.

When you are in the Source Editor window for a file that is being tracked by *TrackBack*, the right end of the status bar shows the number of revisions of this file stored by *TrackBack.*

Chapter 9 Using Graphical Views

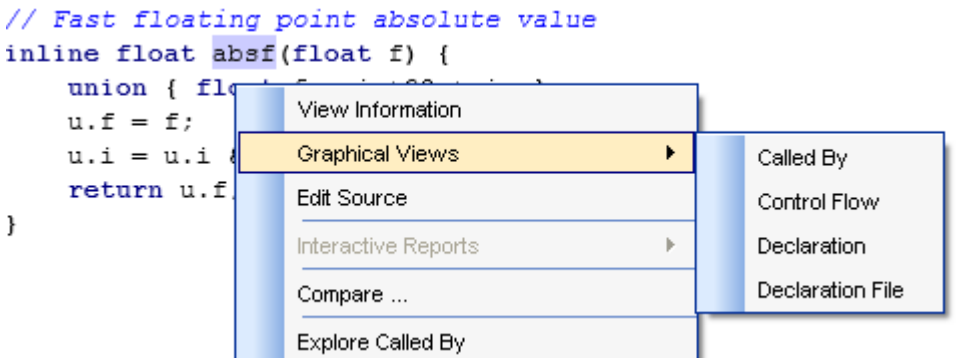
This chapter covers the graphical views in *Understand 2.0* and their options.

This chapter contains the following sections:

Section	Page
Graphical View Browsers	9–2
Controlling Graphics Layout	9–17
Saving Graphical Views	9–28
Printing Graphical and Source Views	9–29

Graphical View Browsers

The right-click menu of an entity that has a structure or hierarchy offers a choice called **Graphical Views**:

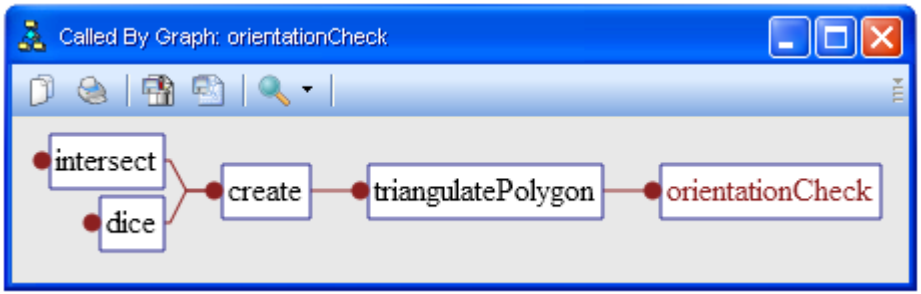


The Graphical Views menu adapts based on what kind of entity has been right-clicked. A greyed-out item refers to information that is normally available for this kind of entity but that is not applicable to this particular entity (for instance a package that could be WITHed but isn't).

There are two main types of graphical views: hierarchy views and structure views.

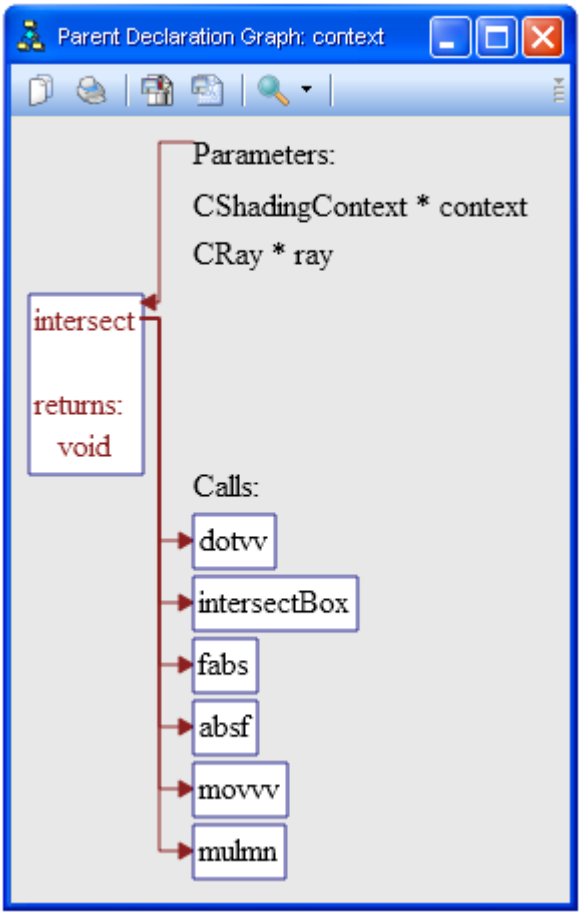
Hierarchy Views

A *hierarchy view* shows multiple level relationships between entities. All relationships are multi-level and are shown to the top or bottom of their respective tree unless a level option is set in the preferences. The following is a Call By graph for a function.



Structure Views

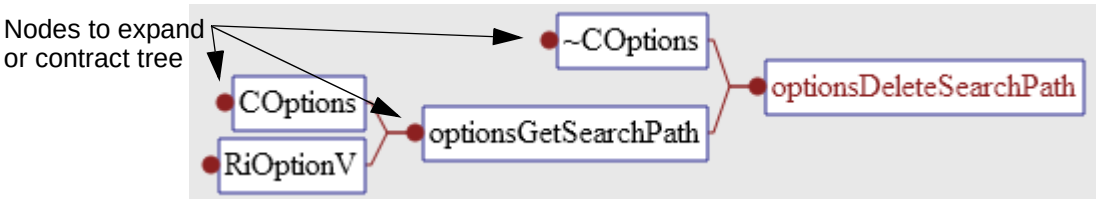
Structure views offer a one glance way to see important structure and relational information about a given entity. The following is an example of a Declaration structure view:



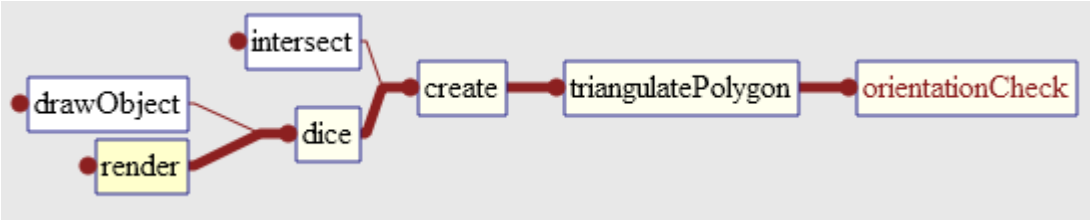
General Rules for Using Graphical Browsers

There are some general rules that can be used for browsing any type of graphical view.

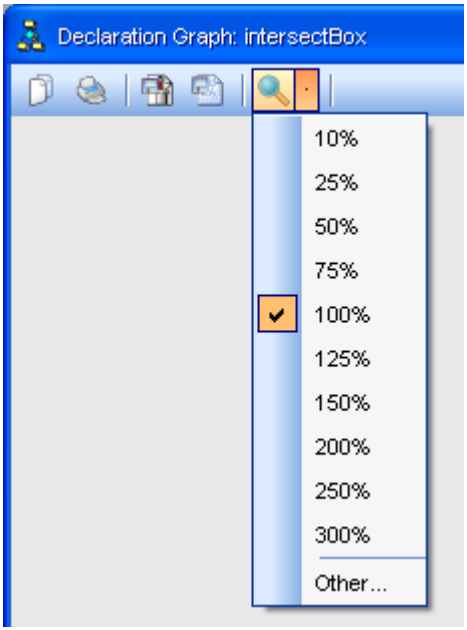
- **Entity info.** Anywhere you see an entity, you can right-click on it to see a menu that offers many ways to learn more about that entity. Single-clicking shows information about the entity in the Info Browser.
- **Opening source.** Double-clicking on an entity in a graphical view opens the source location where the entity is declared.
- **Listing open views.** You can use the Window menu or the tabs across the top of the document area to see a list of all the separate graphical views you have open.
- **Scrolling.** You can scroll around a graphical view dragging your cursor within the view.
- **Expanding hierarchy.** You can expand and contract tree views by clicking the red circle to the right of a node. Right-click on the background of a view and choose **Open All Nodes** or **Close All Nodes** to expand or contract all nodes at once.



- **Path highlighting.** To highlight the path for a particular entity in a tree view (such as a Callby view), select the entity and right-click. In the pop-up menu, choose **Highlight Path**.



- **Zooming.** You can zoom in or out using the toolbar.

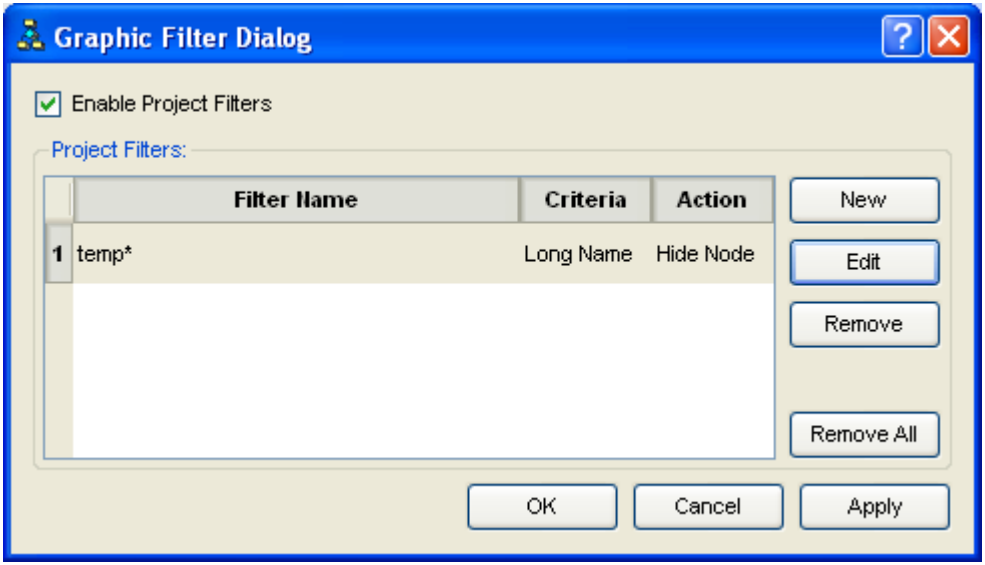


- **Printing and saving.** Everything you see can be printed or saved. Printing may be done to one page (squeezing the picture) or across multiple pages (poster style). See *Printing Graphical and Source Views* on page 9–29 for details on printing. Graphical views can be saved as BMP, JPEG, PNG, and Visio files. See *Saving Graphical Views* on page 9–28 for details on saving to a file.
- **Layout control.** Layout is done automatically, there is no need to move lines or boxes around for a better view. Options are available for changing the layout decisions. For example, you can control whether entities are sorted according to their order in the code or alphabetically. See *Controlling Graphics Layout* on page 9–17.

Filtering Out Entities

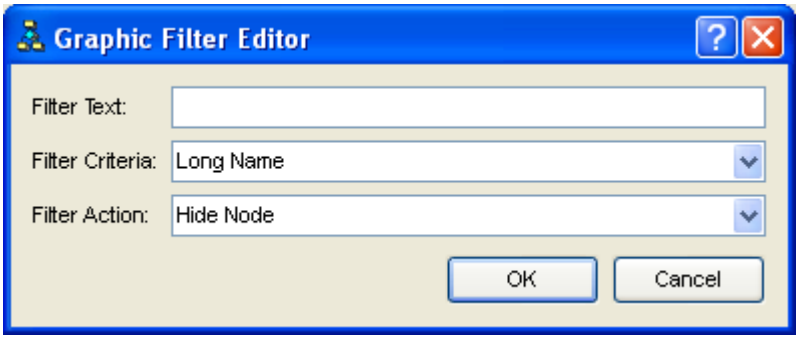
You can apply filters to hide certain entities in graphical views. To create such a filter, follow these steps:

1 Right-click on the background of a graphical view and choose **Edit Graphic Filters** from the pop-up menu.



2 In the Graphic Filter dialog, put a checkmark in the **Enable Project Filters** box.

3 Click **New**. This opens the Graphic Filter Editor dialog.



4 Type a filter in the **Filter Text** field. For example, use gr* to match entity names beginning with gr. Filters are case-sensitive.

5 In the **Filter Criteria** field, select whether to compare the filter to long names, definition files, or the type text of entities. For example, if you choose long names, a filter of print* does not match SomeProc::printWide. Instead, you can type *print*.

6 In the Action field, select one of the following options:

- **Hide Node:** Items that match the filter are not included in the output.
- **Hide Sub Nodes:** The item that matches the filter is shown, but any subnodes of these items are removed from the output.
- **Collapse Sub Nodes:** Any subnodes of items that match the filter are collapsed in the output. An icon is shown after the node to indicate that there are subnodes. Items that match the filter are shown.

7 Click **OK** to add the filter to the project.

You can also create filters by right-clicking on an entity in a graphical view and choosing one of the filtering options. The options allow you to quickly filter out entities with that name or in that file.

You can remove filters you have created by clicking **Remove** or **Remove All**.

The filters you create apply to all graphical views. The status bar tells how many entities are filtered out of the current view. You can temporarily disable filtering in the Graphical Settings dialog or by right-clicking on any graphical view and choosing **Disable Graphic Filters** from the pop-up menu.

Reuse Checkbox

The **Reuse** checkbox controls whether a view is reused or a new window is opened when another graphical view is requested. If you request a graphical view from within a graphical view, that view is reused unless you press Ctrl, no matter whether the **Reuse** box is checked.

The Reuse box is unchecked by default. At most one graphical view can have the **Reuse** box checked at once.

Sync Checkbox

The **Sync** checkbox controls whether this graphical view changes when a different entity is selected in the Project Browser, Entity Filter, and other windows that let you select an entity. For example, if you check the Sync box in a Declaration graph window and then select a different entity in the Entity Filter, the graph shows declaration information for the newly selected entity.

Types of Views

There are two main types of graphical views: hierarchy views and structure views.

Hierarchy View Types

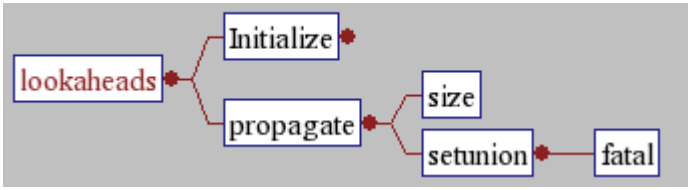
Hierarchical views show multi-level relationships between entities. *Understand 2.0* offers hierarchy graphs of the following types of relationships. Some types apply to specific source languages.

- **Calls** - Shows who this entity calls.
- **Called By** - Shows who calls a given entity.
- **Include** - shows who this file includes.
- **IncludeBy** - shows who includes this file.
- **Derived Classes** - Shows classes derived from a given class.
- **Base Classes** - Show what classes are the base for a class.
- **Extends** - Shows which classes extend this class.
- **Extended By** - Shows which classes are extended by this class.
- **Class Inheritance -** Shows who inherits from a given class.
- **Child Lib Units** - Shows the Child Library Units of a given compilation unit. (Ada 95 only)
- **Declared In** - Shows the declaration tree from where this program unit is declared.
- **Declaration Tree** - Shows the declaration nesting of program units in a compilation unit.
- **Instantiated From** - Shows the instantiation tree of a generic type or compilation unit.
- **Instantiations** - Shows who instantiates a given generic unit.
- **Invocation** - Shows what compilation units a unit invokes.
- **Parent Lib Unit** - Shows the parent lib units of a given entity.
- **Type Derived From** - Shows tree of types a type is derived from.
- **Type Tree** - Shows types that derive new types from an entity.
- **With** - Shows what compilation unit an entity “Withs” into scope.
- **WithBy** - Shows what compilation units “Withs” a given entity.
- **Uses** - Shows which modules use this item.
- **Used By** - Shows which modules are used by this item.

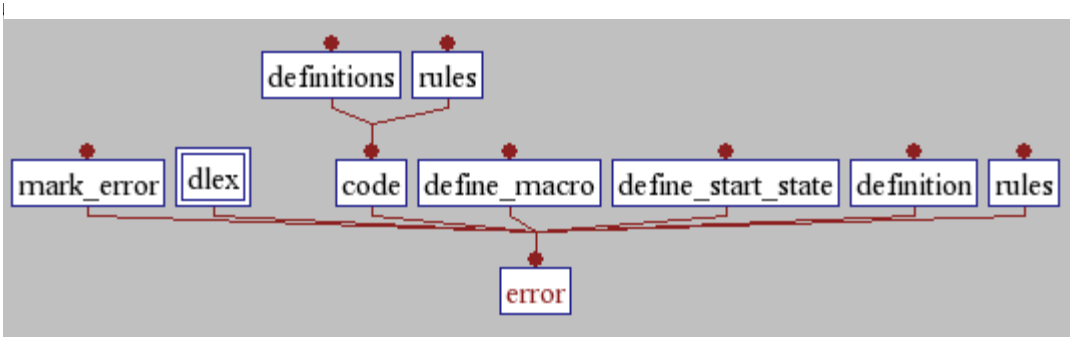
Hierarchy View Examples

Hierarchy views show multi-level relationships between entities. Here are examples of the types of hierarchy views that *Understand 2.0* offers.

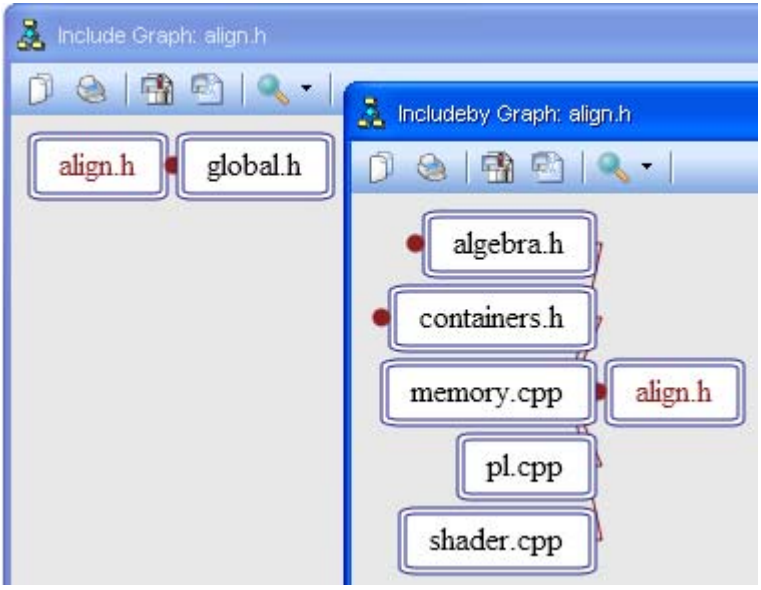
- **Calls** - Shows the entire chain of calls emanating from this function. Each line between entities is read as “x calls y”.



- **Called By** - Shows what calls an entity. Each line connecting an entity is read as “x is called by y”. In this example, error is called by code (and others), which is called by rules (and others). Note that this view is read from the bottom up or right to left.

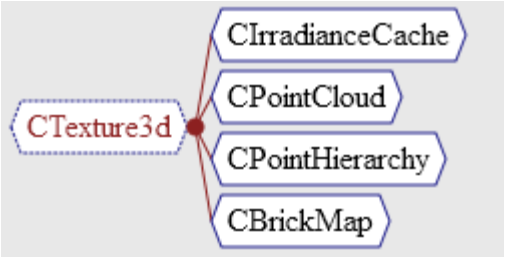


- **Include** - Shows the include hierarchy of an entity, such as a file. A connecting line is read as “x includes y.” In this example, align.h includes global.h.

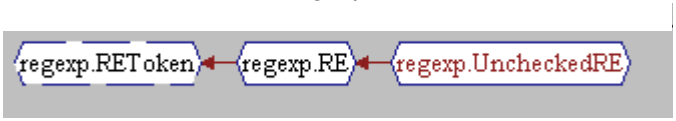


- **Include By** - Shows the include tree in the other direction. In the previous example, align.h is included by several files such as algebra.h.
- **Base Classes**- For classes, shows the base classes from which this class is derived from. In this example, class *CLInearCurve* is derived from class *CCurve* which is derived from class *CSurface* and so on.

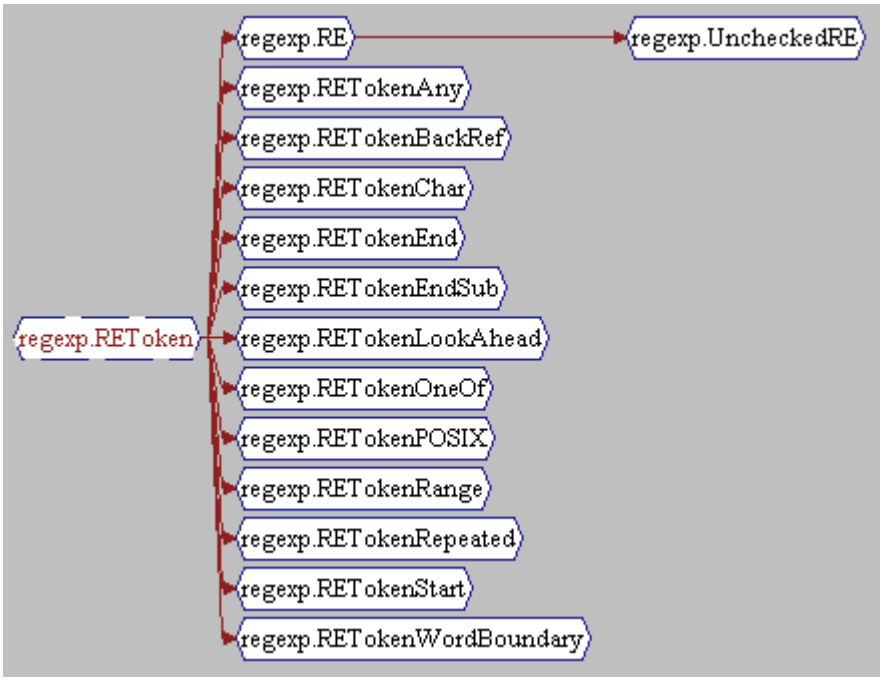
- **Derived Classes** - Shows the classes that are derived from this class. In this example, class *CTexture3d* is a base class for classes *CIrradianceCache* and others.



- **Extends** - Shows which classes extend other classes. In this example, the *regexp.UncheckedRE* class extends the *regexp.RE* class, which extends the *regexp.REToken* class.



- **Extended By** - Shows which classes are extended by other classes. A line is read as “class is extended by class.” In this example, the *regexp.REToken* class is extended by a number of classes, including the *regexp.RE* class, which in turn is extended by the *regexp.UncheckedRE* class.



Structure View Types

Structure views offer a one glance way to see important structure and relational information about a given entity. *Understand 2.0* structure views include the following:

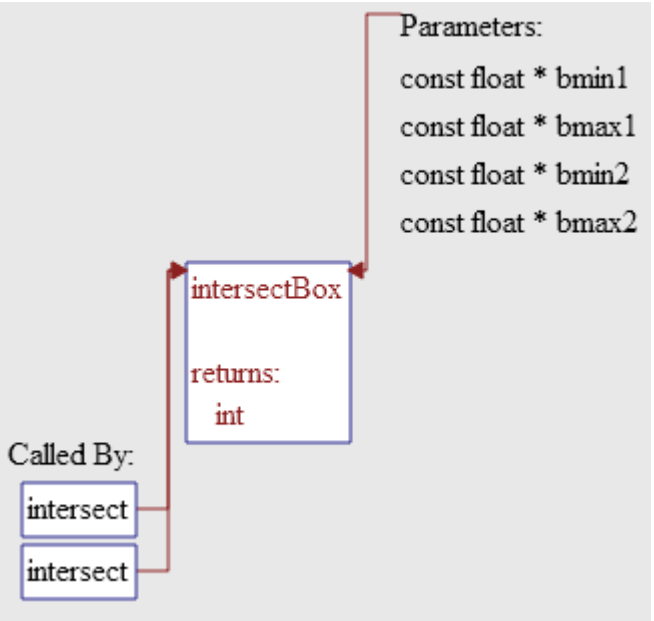
- **Declaration** - Shows what a structure is composed of. For example, shows the parameters, return type, and callbys of a function. For classes, shows what members are provided, who inherits this class, and who it is based on.
- **Parent Declaration** - Shows what a structure is composed of. Shows Calls instead of the Called Bys shown by a Declaration graph.
- **Declaration File** - Shows what entities (such as functions, types, macros, and variables) are defined within a given file.
- **Declaration Type** - Shows what a type is composed of.
- **Data Members** - Shows what components a class, struct, or type contains.
- **Control Flow** - Shows a flow chart of the function or similar entity type.
- **Package** - Shows what entities are declared in a given package (body or spec).
- **Task** - Shows the parameters, invocations, and what entities/entry points are declared in a task. Also shows what the task Withs.
- **Rename Declaration** - shows what entities are renamed in the entity.

Structure View Examples

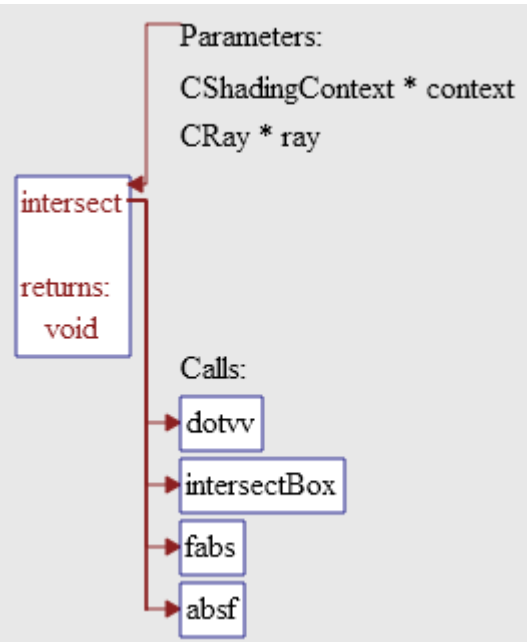
Structure views quickly show structure and relations.

Understand 2.0 structure views are designed to present essential information about an entity in a small and concise manner. The structure diagram is derived from the graphs presented by Booch and Buhr in their respective books “Software Engineering with Ada” and “System Design in Ada.” Where needed, symbols and annotations have been extended or altered to represent new kinds of information available from *Understand 2.0*.

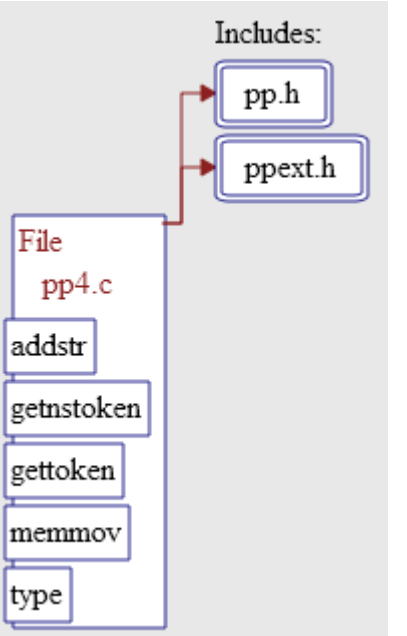
- **Declaration** - Shows the structure of the entity. For example, shows the parameters, return type, and callbys of a function.



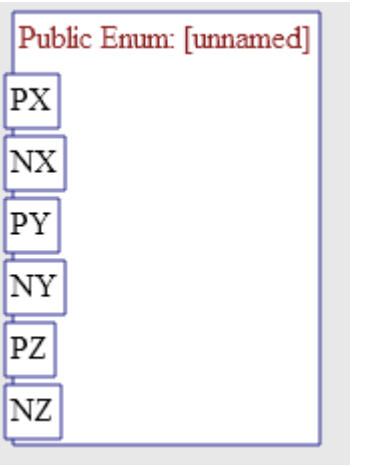
- **Parent Declaration** - Similar to a Declaration graph but shows what the entity calls.



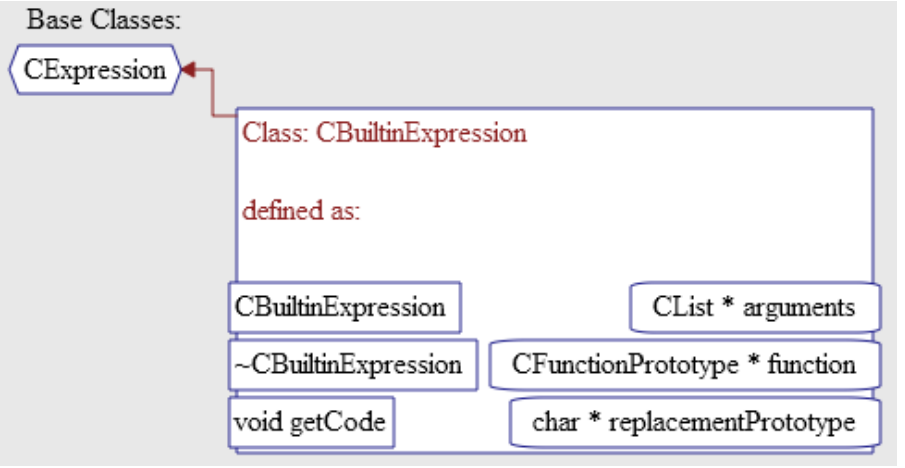
- **Declaration File** - Shows the entities declared in the file. Also shows files included by the file and classes imported by the file.



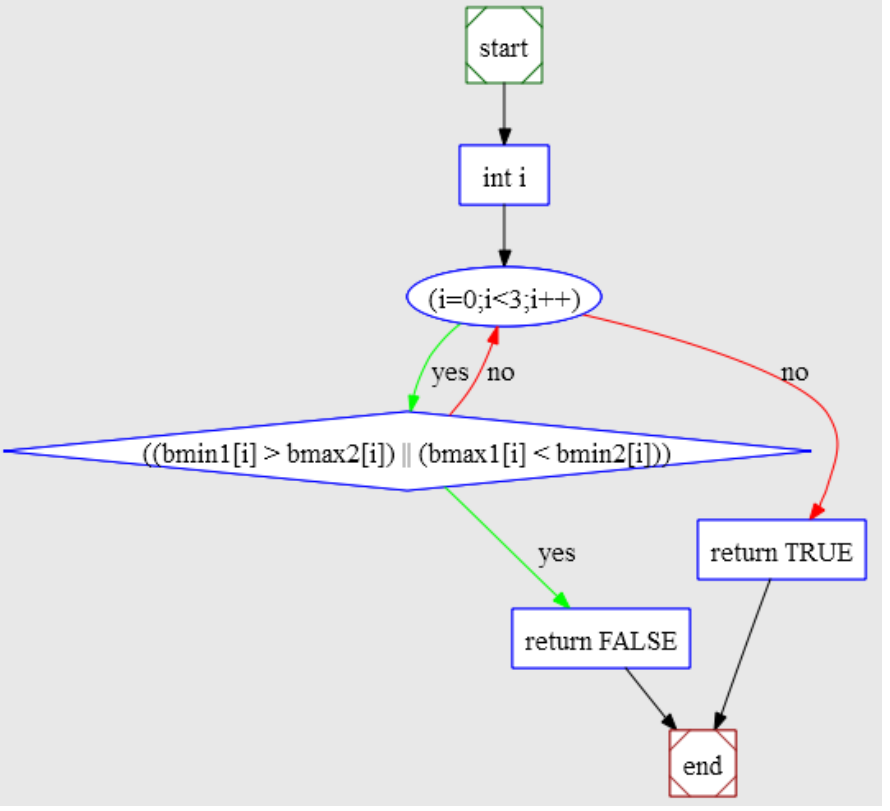
- **Declaration Type** - Shows information about a type declaration.



- **Class Declaration** - Shows the members defining the class and the parent class from which it is derived.



- **Control Flow** - Shows a flow chart of the function or similar entity type.



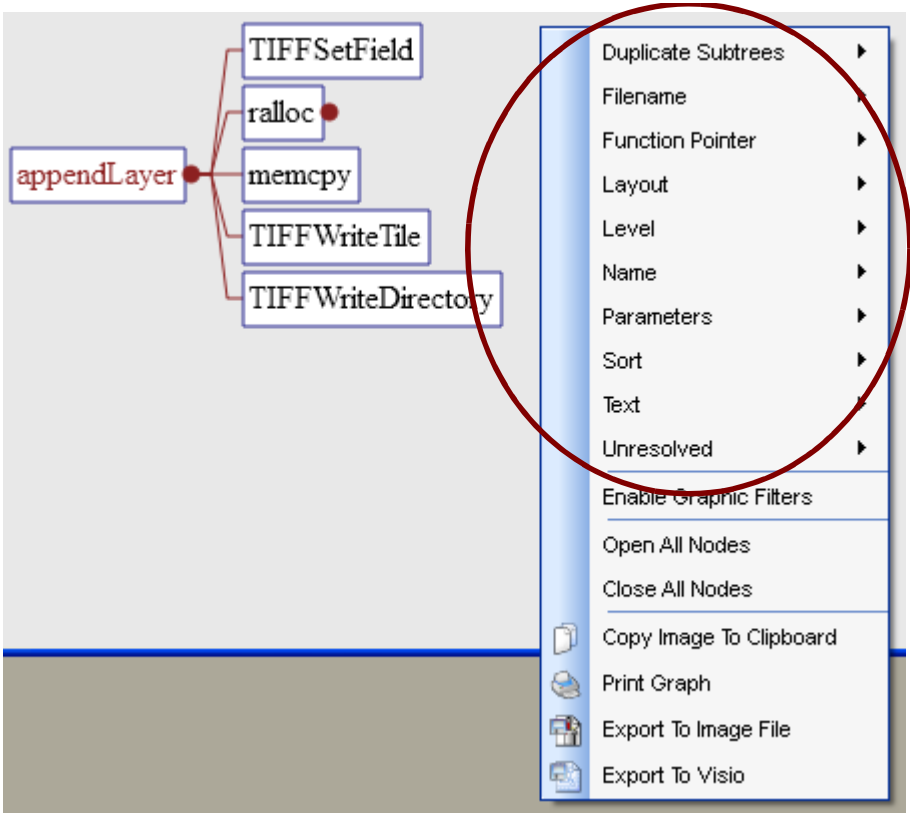
Graphical Notation

The following symbols are used by *Understand 2.0* to represent various language constructs.

- Most entities (such as functions and other program units) are shown in rectangles.
- Files and system-level entities are shown as double-bordered rounded rectangles.
- Classes and types are shown in flattened hexagons.
- Unknown or unresolved entities are drawn with dashed outlines.
- Oval denotes a variable.
- A slash through a variable means it is a constant.
- Other shapes are language-specific.

Controlling Graphics Layout

The two main types of graphical view windows, ***Hierarchy*** and ***Structure***, have a variety of configuration options. You can set them by right-clicking on the background of a graphical view and choosing the option you want to modify from the pop-up menu.

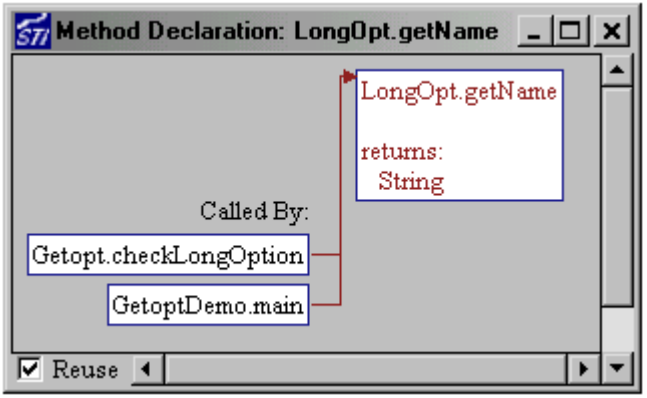


These options control the layout and drawing of the graphic views and vary based on the current type of view.

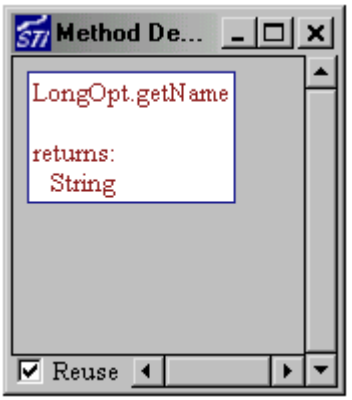
Called by Menu

The **Called by** menu controls whether program units that call the current entity are shown in declaration views.

View with Called By set to On



View with Called By set to Off



Constants Menu

The **Constants** menu controls whether to show constants in Declaration views. The default is On.

Default Members Menu

The **Default Members** menu controls whether declaration views show default members of the class.

Dependent Of Menu

The **Dependent Of** menu controls whether files a C file is dependent on are drawn in the C File Declaration view. The Default is On.

Dependent Menu

If **Dependents** is on (the default) then files dependent on the current C file are shown in a File Declaration view.

Duplicate Subtrees Menu

The **Duplicate Subtrees** menu controls whether multiple occurrences of the same sub-tree are shown in hierarchy views. The options are to Hide or Show such subtrees. The default is to show duplicate subtrees. In some applications, hiding duplicate subtrees can dramatically simplify hierarchy views. Duplicate subtrees are not shown if a view has over 1000 nodes.

Extended By Menu

The **Extended By** menu controls whether declaration views show classes by which the selected class is extended.

Extends Menu

The **Extends** menu controls whether declaration views show classes that the selected class extends.

External Functions Menu

If **External Functions** is on then functions defined in a header file or in a file included by a header file are shown in the Declaration View for a header file. Default is On.

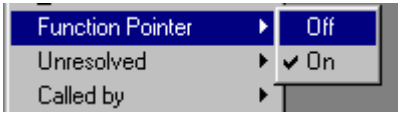
Filename Menu

The **Filename** menu controls how filenames are displayed in views. It is available for both declaration and hierarchy views. The options are Off and On.:

- **None** - Filenames are not shown in the view.
- **Shortname** - Where filenames are relevant, only the name of the file is shown in square brackets.
- **Fullname** - Where filenames are relevant, the full file path and filename are shown in square brackets.

Function Pointer Menu

The **Function Pointer** menu controls whether function pointers are displayed as invocations in the Call and CallBy trees.



Globals Menu

The **Globals** menu controls whether to show globals in Declaration views. The default is On.

Implements Menu

The **Implements** menu controls whether declaration views show entities that the selected entity implements.

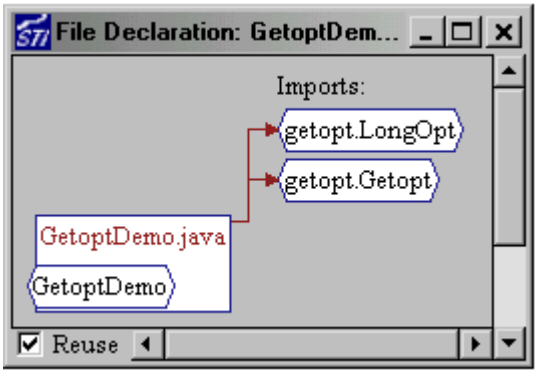
Implemented By Menu

The **Implemented By** menu controls whether declaration views show entities by which the selected entity is implemented.

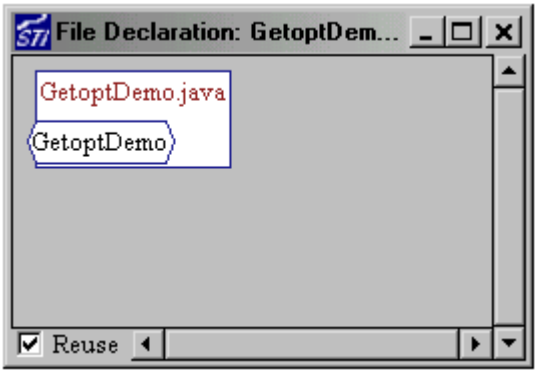
Imports Menu

The **Imports** menu controls whether declaration views show entities imported by the current entity.

View with Imports set to On



View with Imports set to Off



Included By Menu

If **IncludeBy** is on (default) then files that include the Header File being drawn in a Header File Declaration view are shown.

Includes Menu

The **Includes** menu controls if include files are drawn on file declaration diagrams (C file, Header file). Default is On.

Inherits Menu

The **Inherits** menu controls whether declaration views show entities that the selected entity inherits.

Inherited By Menu

The **Inherited By** menu controls whether declaration views show entities inherited by the selected entity.

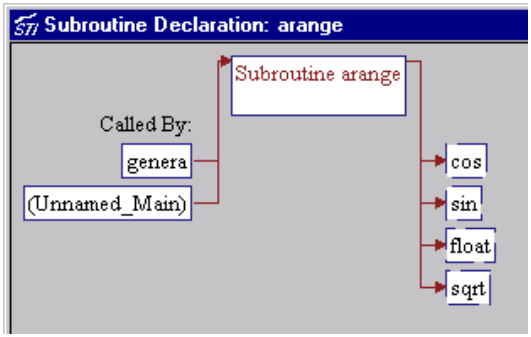
Intrinsic Menu

The **Intrinsic** menu controls whether intrinsic functions (e.g. cos, sin) are displayed or hidden.

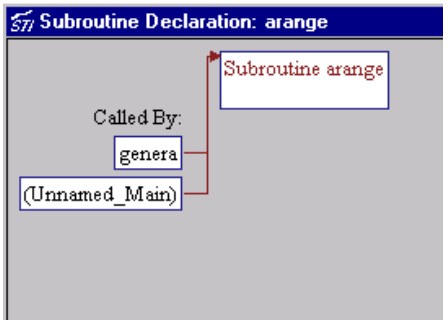
Invocations Menu

The **Invocations** menu controls whether procedures and functions called by the current procedure or function are shown in Declaration views.

View shows Invocations



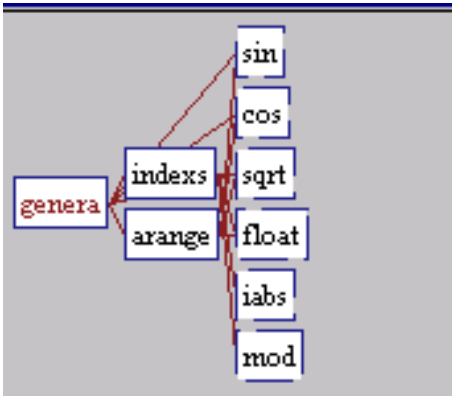
View without Invocations shown



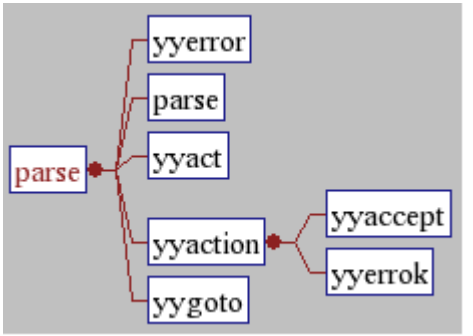
Layout Menu

The **Layout** menu controls the layout algorithm for a hierarchical chart. It is available only in hierarchy views (calls, callby, etc.). The options are:

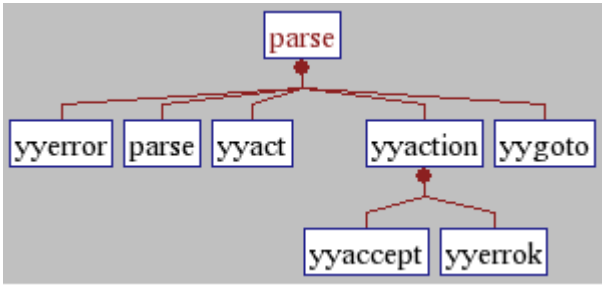
- **Crossing** - a left-to-right view, minimizing space used but sacrificing some readability by permitting lines between entities to cross.



- **Horizontal Non-Crossing** - a left-to-right layout, using more space in some situations but enhancing readability by having no crossing lines.

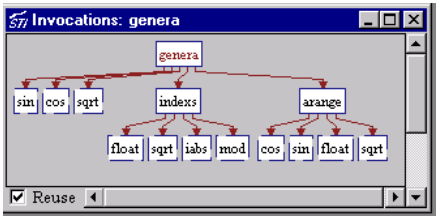


- **Vertical Non-Crossing** - an top-to-bottom layout similar to Horizontal Non-Crossing.

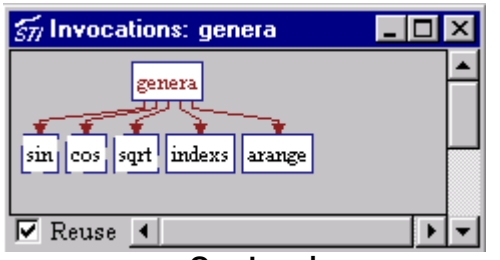


Level Menu

The **Level** menu controls the number of levels to be traversed when laying out a hierarchical view. The default value is “All Levels”. Values of 1 to 5 may be set. It is available only in hierarchy views.



All Levels



One Level

Locals Menu

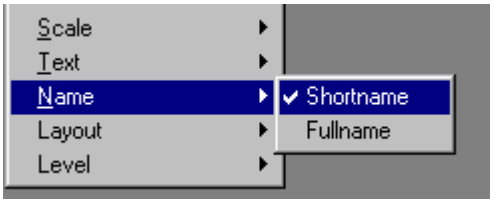
The **Locals** menu controls whether local items are shown in Declaration views. The default is On.

Members Menu

The **Members** menu controls whether members and operators are shown in the Type Tree and Type Derived From views. The choices are to show None, Components, Operators, or Operators and Components.

Name Menu

The **Name** menu controls whether or not fullnames are used in views. It is available for both declaration and hierarchy views.



A fullname includes its parent compilation units. For example:

- Text_Io.Put is the fully specified name.
- Put is the Short Name

Longer versus shorter names can alter the layout of pictures substantially.

Objects Menu

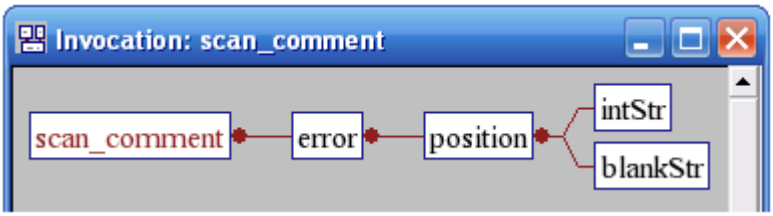
The **Objects** menu controls whether to show objects in Declaration views. The default is On.

Operators Menu

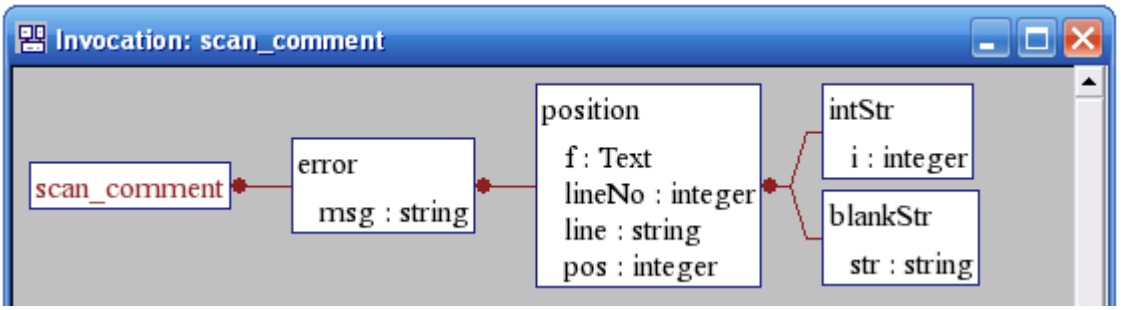
The **Operators** menu controls whether entities that are operators are shown in the Callby, Declaration, Declaration Tree, and Invocation views.

Parameters Menu

The **Parameters** menu controls whether parameters are shown in hierarchical views. Available on any hierarchical graphical view (invocation and callby). The default is Off, turning this On can make hierarchical pictures much bigger.



Parameters Off (the default)



Parameters On

Private Members Menu

The **Private Members** menu controls whether declaration views show private members of the entity.

Protected Members Menu

The **Protected Members** menu controls whether declaration views show protected members of the entity.

Public Members Menu

The **Public Members** menu controls whether declaration views show public members of the entity.

Renames Menu

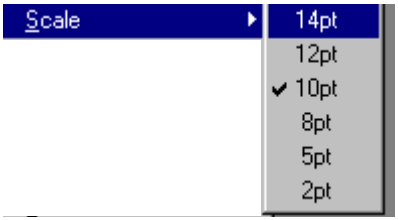
The **Renames** menu controls whether declarations that are renames are shown in Declaration views. The default is to show rename declarations.

Routines Menu

The **Routines** menu controls whether to show routines (procedures, functions, ...) in Declaration views. The default is On.

Scale Menu

The **Scale** menu allows you to choose the size of the text used. It is available for both declaration and hierarchy views. All picture sizes and layouts vary with text point size. The currently selected size is indicated by a check mark.



Other point sizes can be added by customizing configuration files found in the *Understand 2.0* installation directory. Contact *support@scitools.com* for information on how to do this.

Sort Menu

The **Sort** menu lets you specify whether entity names in tree views should be sorted alphabetically. If this option is off (the default), entities are sorted in the order they are encountered in the project.

Spacing Menu

The **Spacing** menu lets you choose to change the space between boxes. You can choose compact, small, normal, wide, or extra wide.

Sql Menu

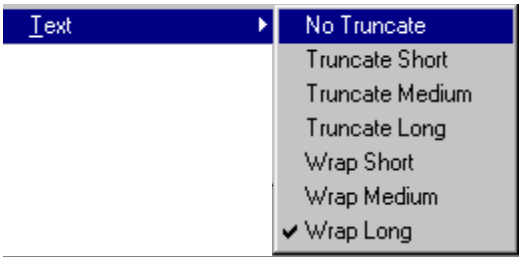
The **Sql** menu lets you specify whether SQL entities should be shown in graphical views. This option is on by default.

Static Menu

The **Static** menu controls if static functions are drawn in function, C File and Header File declaration views. Static functions are those declared using the “static” keyword. They are visible only within the file they are declared in. If enabled static functions are drawn with the edge of their box inside the edge of the outer declaration box for their enclosing unit (C file). Default is On.

Text Menu

The **Text** menu sets the way entity names are trimmed or altered to accommodate the layout of graphics. It is available for both declaration and hierarchy views. Names may be truncated to a certain length or wrapped at a certain length.



- **No Truncation -** Uses the name as defined in the source code. The default.
- **Truncate Short** - Cuts off names at 10 characters.
- **Truncate Medium** - Cuts off names at 20 characters.
- **Truncate Long** - Cuts off names at 30 characters.
- **No Wrap** - Never wraps text to the next line.
- **Wrap Short** - Wraps the name between 8 and 10 characters. Location in that range depends on if a natural wrapping character is found. Natural wrapping characters are . _ - and :
- **Wrap Medium** - Similar to *Wrap Short* except wrapping range is 15-20 characters.
- **Wrap Long** - Similar to *Wrap Short* except wrapping range is 20-30 characters.

Types Menu

The **Types** menu controls whether to show types in Program Declaration views. The default is On.

Typetext Menu

The **Typetext** menu tells declaration views (Function Declaration, C File Declaration, Header File Declaration) to include types on the view. Default is On.

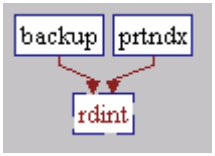
Unknown Menu

The **Unknown** menu controls whether entities that are used, but for which no declaration was found should be drawn. Unknown methods and entities are those used in the analyzed source without a definition in the same source.

Unresolved Menu

The **Unresolved** menu controls whether entities that have been used but no declaration was found should be drawn. This option is available on hierarchy and structure views. Unresolved functions and entities are those used in the analyzed source without a definition in the same source. Unresolved include files are those included but not found along a declared include path (either a compiler or project include path).

Unresolved entities are drawn as normal but with a dashed border:



Usedby Menu

The Usedby menu tells Declaration views whether to show items that use this item.

Uses Menu

The Uses menu tells Uses views whether to show only items that are used directly, or to also show items that are used by nested subprograms. The default is to show both.

Variables Menu

The **Variables** menu controls whether to show globals in Declaration views. The default is On.

Withs Menu

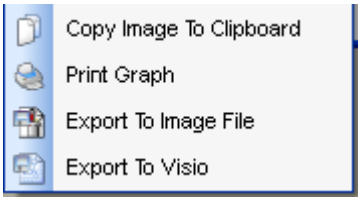
The **Withs** menu controls on Declaration views of compilation units (packages, tasks, separate procedures, etc...) if Withs are drawn. The default is On.

With Bys Menu

Controls if With Bys (who Withs a given compilation unit) are shown on Declaration views. The default is On.

Saving Graphical Views

Understand 2.0 offers a number of ways to export your graphical views and use them in other ways. To see these options, right-click on the background of a graphical view. The lower part of the pop-up menu shows the export options. The icons for these options are also available in the toolbar for the graphical view.



In addition to printing, you can save graphical views as BMP, JPEG, PNG, SVG, and Visio files. The first four formats are common graphics formats. The last format requires the Visio software.

Saving Views to Files

To save a graphical view in one of the following formats, right-click on the background of the view and choose **Export to Image File** from the pop-up menu. In the Export dialog, choose a location, filename, and file type for the view.

- **BMP** files are uncompressed bitmaps commonly used by Microsoft Windows applications.
- **JPEG** files are compressed bitmaps. They can be viewed with most web browsers, document editors, and graphics programs. This format is “lossy”; some data is lost in the compression.
- **PNG** files store compressed bitmaps similar to GIF files. They can be viewed with most web browsers, document editors, and graphics programs. They use a non-patented compression method.
- **SVG** files are Scalable Vector Graphics files. This file type uses XML to describe a 2-dimensional vector-based image.

You can also copy a graphical view to the clipboard and paste it as a bitmap into the image program or word processor of your choice. To do this, right-click on the background of the view and choose **Copy Image to Clipboard** from the pop-up menu. Then, paste the image into another program.

Saving Views as Visio Files

Microsoft Visio is a vector-based graphics program used for drawing flowcharts and similar graphics. That is, it deals with shapes and objects rather than pixels.

In order to save a graphical view as a Visio file, you must have Visio 5 or a later version installed on your computer. (Visio 2000 is equivalent to Visio 6.)

To save a Visio file, right-click on the background of the view and choose **Export to Visio** from the pop-up menu.

If Visio is not open, *Understand 2.0* opens it and begins creating objects to match the ones in the graphical view. The process of creating all the objects may take some time for a large graphical view. A progress bar is shown in *Understand 2.0* while the file is being created. Avoid exiting Visio or attempting to stop the process of creating the Visio diagram while it is in progress.

Once the view has been drawn in Visio, use Visio to save the file.

Printing Graphical and Source Views

Understand 2.0 has these printing modes:

- **Source File** printing simply queues the file to the printer using 66 lines of source per page.
- **Graphical view printing** fits a picture, no matter what its size, onto the current printer page size.

Graphical View Printing

Graphical views can be printed with the **File->Print** menu option. (The right-click menu for a graphical view also has a **Print Graph** command.)

The **File->Print File Setup** menu option applies only to printing source code and other text files.

Choosing **File->Print** prints the graphic, making it fit on the given page size. On Windows, the standard Windows printer setup dialog can be used to configure printing options available for your printer.

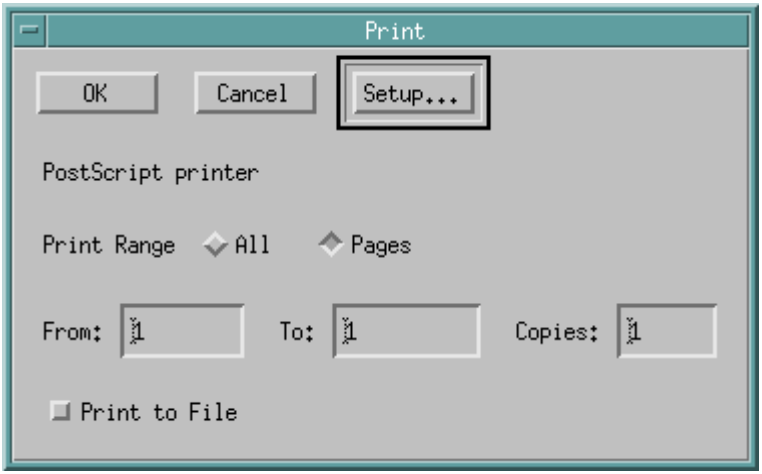
See *Printing on UNIX Machines* on page 9–30 for more information about configuring printouts on UNIX machines.

Printing on UNIX Machines

On UNIX machines *Understand 2.0* uses Postscript as its primary output format. The output files created are Level 2, Encapsulated Postscript without a preview image.

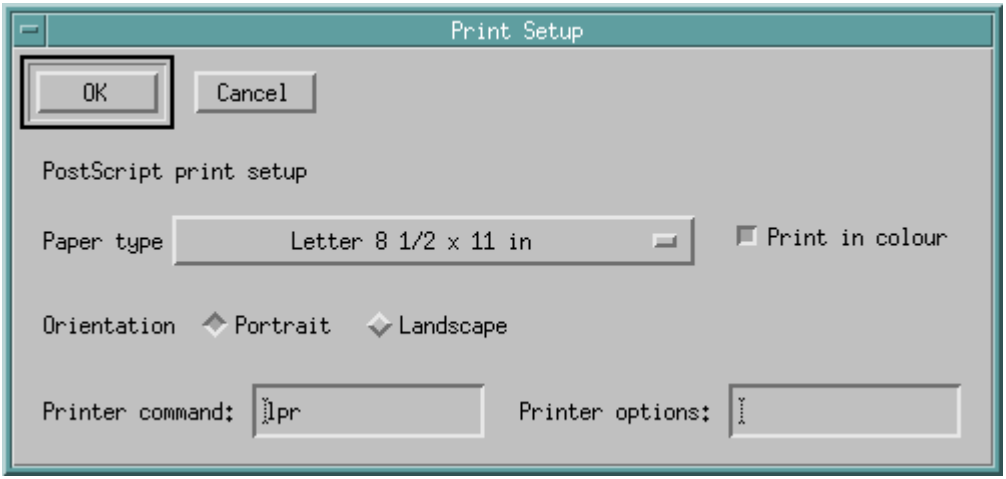
All output is to a file, the file can optionally be sent to a queuing command (such as *lp* or *lpr*).

Initially the Print Dialog appears:

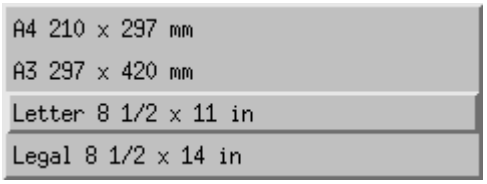


- **Print Range** specify optional range of pages (if more than one page)
- **Copies -** specify number of copies of each printed page
- **Print to File**, if checked then a dialog is displayed so you can specify what file to print to.

- **Setup** - use to further configure printing, as shown in this panel:



  - **Printer Command** - Sets the system command used to print. The default is lpr. This command name may be set to any command. No checking is made to ensure it is a valid command or that it is on your executable search path. The name of the Postscript file is passed as its first argument. The text (if any) contained in the **Printer Options** field is passed as arguments following the Postscript file name.
  - **Paper Types Toggle** - - Lets you choose what paper size to use. The default is 8 1/2 by 11 (letter).



Chapter 10 Generating Reports and Metrics

This chapter describes how to create and view reports and the types of reports available.

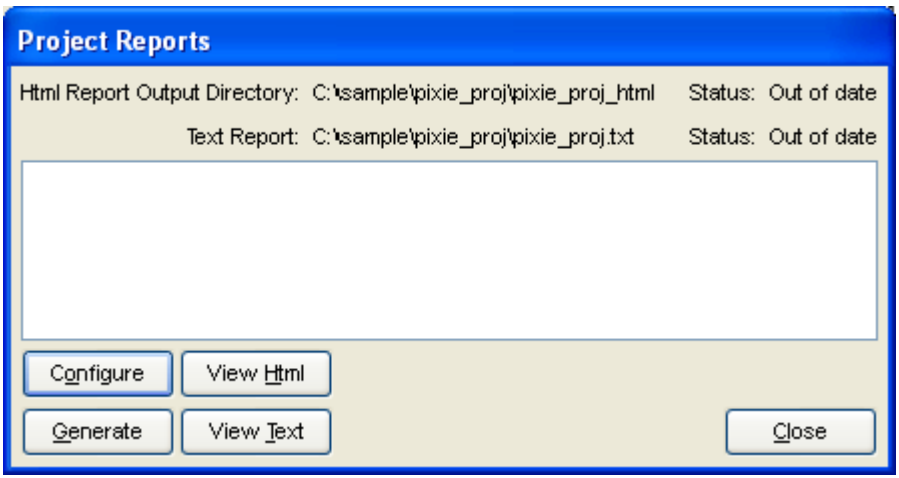
This chapter contains the following sections:

Section	Page
Configuring Reports	10–2
Generating Reports	10–4
Viewing Reports	10–5
An Overview of Report Categories	10–6
Cross-Reference Reports	10–8
Structure Reports	10–14
Quality Reports	10–18
Metrics Reports	10–22
Exporting Metrics	10–27

Configuring Reports

Understand 2.0 provides a large number of reports you can generate about your code. These can be generated in HTML or text format. You can choose which reports and how to format them.

To begin generating reports, choose **Project->Project Reports**.

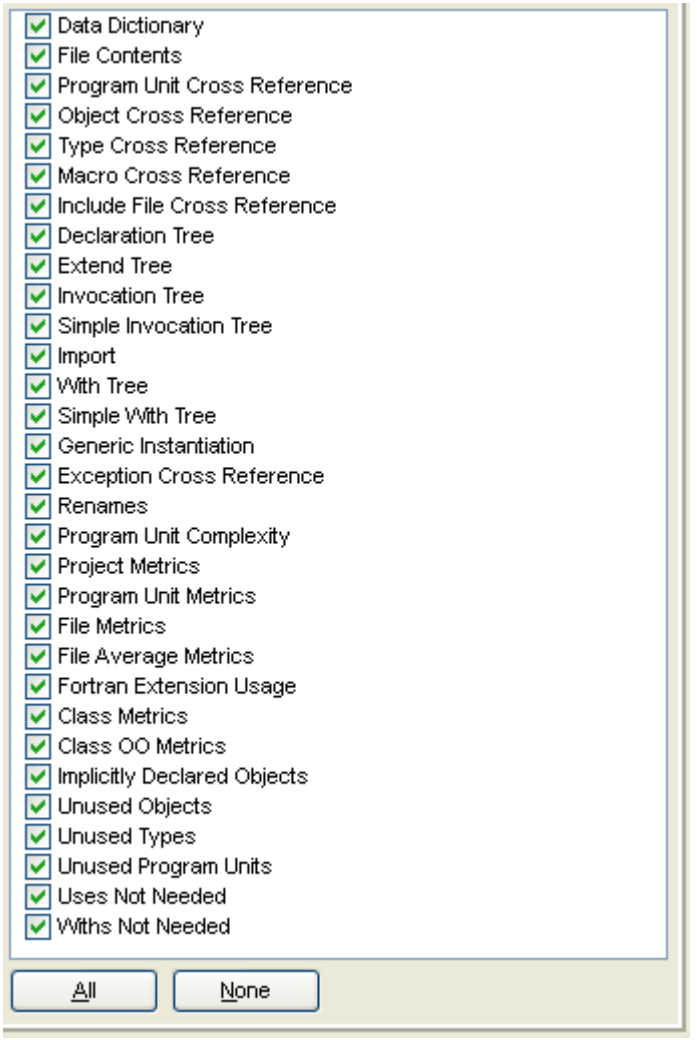


The **Configure** button opens the Project Configuration dialog with the **Reports->Output** category selected. See page 3–19 for details.

- **HTML reports.** The “home” file for the reports is index.html, but you can select an alternate title page. You may generate single or multiple HTML files for each report type. It is recommended that you split up the files for large projects. Choose *Alphabetic* to generate multiple HTML files per report which are split up alphabetically by the first letter of the entity name. Choose *Every n Entities* to generate multiple HTML files per report which are split up every “n” number of entities. By default, a single HTML file is generated for each letter of the alphabet.
- **Text reports.** You may generate one text file of the specified name (by choosing File). Alternately, you may generate multiple text files (by choosing Separate) and specify a common filename prefix. The file extensions of each text file will denote the separate reports.

For details on the **Reports->Options** category, see page 3–20.

The **Reports->Selected** category lets you select from the available reports for the languages used by your project. This list shows all the reports for all languages:



See *An Overview of Report Categories* on page 10–6 for descriptions of the types of reports you can generate.

Generating Reports

Once you have specified formatting options and the types of reports to be generated, click **Generate** in the Project Reports dialog to begin generating the selected reports.

On Windows, the ASCII text follows the DOS text file format (carriage return and line feed at the end of each line). On UNIX, text files are created according to the UNIX convention (lines end with a carriage return).

HTML reports are generated as HTML 3.0 format files. The generated HTML is not complex, the only HTML 3.0 (versus HTML 2.0) feature used is frames. Netscape 2.0 and higher, and Internet Explorer 3.0 and higher can display the files.

You can view the reports as described in *Viewing Reports* on page 10–5.

For large projects, reports can take a long time to generate. You can click **Cancel** to halt report generation. Clicking **Cancel** leaves the reports in a partially generated state.

Note: You may want to temporarily toggle off anti-virus protection programs while reports are being generated. This may speed the process of creating reports. If you do this, be sure to turn on virus checking after report generation is finished.

Note: HTML, text, and project metrics reports may also be generated with the “und” command line program. Refer to Chapter 12 for details.

Viewing Reports

To view generated reports, choose **Project->Reports**. Then click the **View HTML** or **View Text** button.

File names of reports generated vary based on the type and format of the report generated.

- For text files, a single text file containing all selected reports may be generated or separate files for each type of report may be generated. A single text file is named <*project_name*>.txt. For separate text files, the file name is the type of report.
- For HTML reports, you can generate either a single HTML files for each report type, or smaller files divided either alphabetically by entity name or in groups of N number of entities. An index file is also generated that contains links to all the other HTML reports generated. The main window page is named index.html.

For HTML reports, a single index file contains an alphabetic list of all entities found in all other generated HTML reports. The entities listed in the index have hyperlinks to the Data Dictionary report for that entity. The entity index file is named entity_index.html and can be accessed from the “index” link on the main HTML page.

The following figure shows an example of the entity index.

An Overview of Report Categories

Understand 2.0 generates a wide variety of reports. The reports fall into these categories:

- **Cross-Reference** reports show information similar to that in the *Info Browser*, except that all entities are shown together in alphabetic order. See *Cross-Reference Reports* on page 10–8.
- **Structure** reports show the structure of the analyzed program. See *Structure Reports* on page 10–14.
- **Quality** reports show areas where code might need to be examined. See *Quality Reports* on page 10–18.
- **Metrics** reports show basic metrics such as the number of lines of code and comments. See *Metrics Reports* on page 10–22.

The following table shows the type and page number for each report.

Report Type	Report Name and Page
Cross-Reference	*Data Dictionary Report* on page 10–8
Cross-Reference	*File Contents Report* on page 10–10
Cross-Reference	*Program Unit Cross-Reference Report* on page 10–9
Cross-Reference	*Object Cross-Reference Report* on page 10–10
Cross-Reference	*Type Cross-Reference Report* on page 10–11
Cross-Reference	*Macro Cross-Reference* on page 10–12
Cross-Reference	*Include File Cross-Reference* on page 10–12
Cross-Reference	*Exception Cross-Reference Report* on page 10–13
Structure	*Declaration Tree* on page 10–14
Structure	*Class Extend Tree* on page 10–15
Structure	*Invocation Tree Report* on page 10–16
Structure	*Simple Invocation Tree Report* on page 10–16
Structure	*Import Report* on page 10–17
Structure	*With Tree Report* on page 10–16
Structure	*Simple With Tree Report* on page 10–17
Structure	*Generic Instantiation Report* on page 10–17
Structure	*Renames Report* on page 10–17
Quality	*Program Unit Complexity Report* on page 10–18
Quality	*Unused Objects Report* on page 10–20
Quality	*Unused Types Report* on page 10–21
Quality	*Unused Program Units Report* on page 10–21

Report Type	Report Name and Page
Quality	*Withs Not Needed Report* on page 10–21
Quality	*Implicitly Declared Objects Report* on page 10–20
Quality	*FORTRAN Extension Usage Report* on page 10–19
Metrics	*Project Metrics Report* on page 10–23
Metrics	*Program Unit Metrics Report* on page 10–24
Metrics	*File Metrics Report* on page 10–25
Metrics	*File Average Metrics Report* on page 10–26
Metrics	*Class Metrics Report* on page 10–23
Metrics	*Class OO Metrics Report* on page 10–24

Augment with the PERL or C API

The reports included with *Understand 2.0* have evolved over many years to accommodate common customer requests. However, we recognize that not all needs can be covered.

To help you develop custom reports we include both PERL and C interfaces to *Understand 2.0* databases.

For details on the PERL interface choose **Help->PERL API Documentation** and **Help->FAQ**.

Cross-Reference Reports

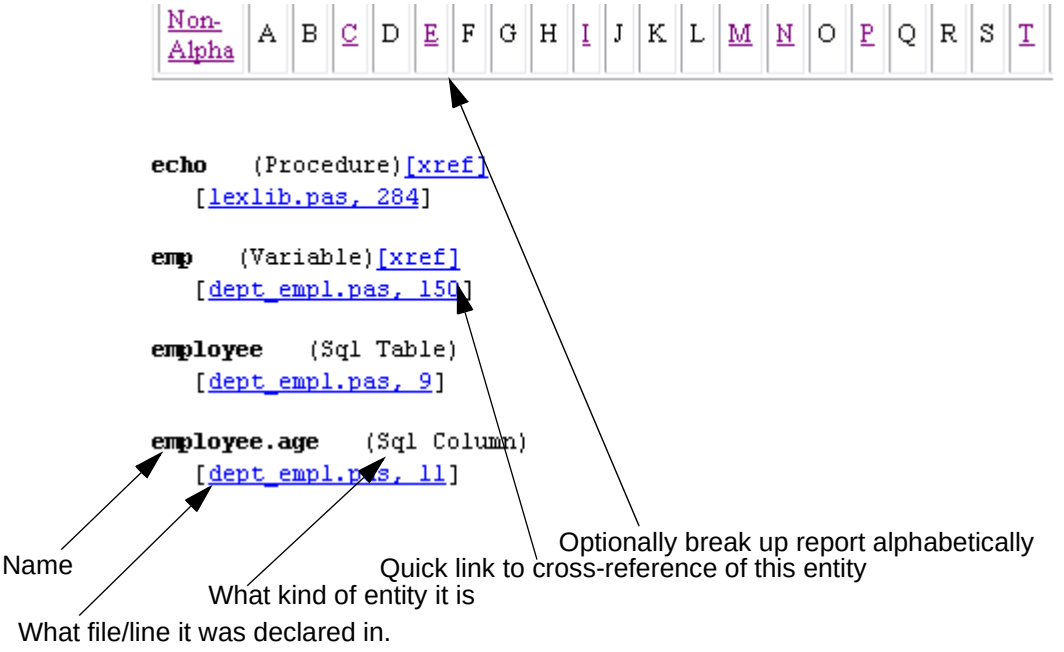
Cross-Reference reports show information similar to that in the References section of the Info Browser, except that all entities are shown together in alphabetic order. The following table shows the page that describes each type of cross-reference report.

Report Name
Data Dictionary Report on page 10–8
Program Unit Cross-Reference Report on page 10–9
File Contents Report on page 10–10
Object Cross-Reference Report on page 10–10
Type Cross-Reference Report on page 10–11
Class and Interface Cross-Reference on page 10–11
Macro Cross-Reference on page 10–12
Include File Cross-Reference on page 10–12
Exception Cross-Reference Report on page 10–13

Data Dictionary Report

The *Data Dictionary Report* lists all entities alphabetically. Each listing shows the entity name, what kind of entity it is (for example,

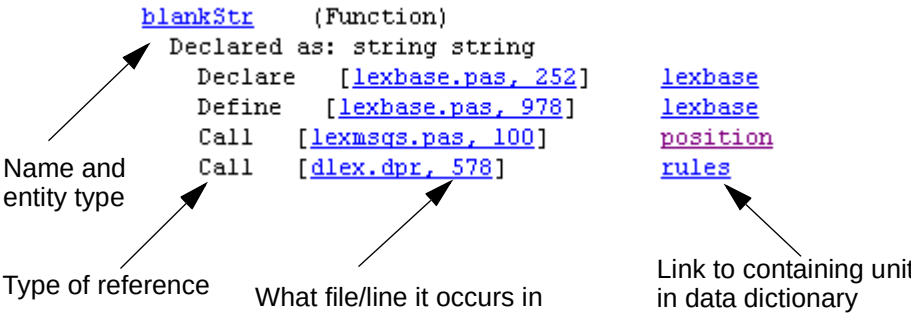
macro, type, variable, function, include, file, or procedure), along with links to the location where each is declared in the source code.


Non-Alpha A B C D E F G H I J K L M N O P Q R S T
echo (Procedure)[xref]
[lexlib.pas, 284]
emp (Variable)[xref]
[dept_empl.pas, 150]
employee (Sql Table)
[dept_empl.pas, 9]
employee.age (Sql Column)
[dept_empl.pas, 11]
Name
What file/line it was declared in.
What kind of entity it is
Quick link to cross-reference of this entity
Optionally break up report alphabetically

Program Unit Cross-Reference Report

The *Program Unit Cross-Reference Report* lists all program units (such as procedures and functions) analyzed in alphabetic order along with information about what they return (if anything), what parameters are used, and where they are used by other program units.

The HTML version offers hyperlinks to the Data Dictionary report entry and to the source code where each reference occurs.


blankStr (Function)
Declared as: string string
Declare [lexbase.pas, 252] lexbase
Define [lexbase.pas, 978] lexbase
Call [lexmsgs.pas, 100] position
Call [dlex.dpr, 578] rules
Name and entity type
Type of reference
What file/line it occurs in
Link to containing unit in data dictionary

You can create an additional Program Unit Index report to list all the program units in the project and show the file and line where each is declared. For text reports, this is stored in a *.pcn file.

File Contents Report

Lists functions declared within a source file and the line numbers where they are declared. HTML versions of this report permit hyperlinked jumping to the function in the source as well as viewing of the entire source file.

```
regerror.c
  Global Functions
    regerror

regexp.c
  Local Variables
    regbol
    regcode
    regdummy
    regendp
    reginput
    regnpar
    regparse
    regsize
    regstartp
```

Object Cross-Reference Report

The Object Cross-Reference Report lists all objects (FORTRAN *variables, parameters, macros*) in alphabetic order along with declaration and usage references.

```
UMINUS     (Const)
  Declared as: 259
    Define    [expr.dpr, 19]          expr

undefined_symbol     (Const)
  Declared as: '202: undefined symbol'
    Define    [lexmsgs.pas, 67]       lexmsgs
    Use    [lexrules.pas, 179]        push_macro
    Use    [lexrules.pas, 259]        add_start_state
```

The HTML version of this report includes hyperlinks to the Data Dictionary Report and the source code where the reference occurs.

Type Cross-Reference Report

The Type Cross-Reference Report lists all declared types in alphabetic order, along with their declaration and usage information. The HTML version of the report offers hyperlinks to the Types data dictionary report entry, as well as the source code where the reference occurs.

```
final     (Field)
  Declared as: Boolean
    Define    [lextable.pas, 99]       StateTableEntry

FirstPosTable     (Type)
  Declared as: array[0..2*max_start_states] of IntSetPtr
    Define    [lextable.pas, 89]       lextable
    Typed     [lextable.pas, 129]      first_pos_table
```

Class and Interface Cross-Reference

The Class and Interface Cross-Reference Report lists all declared classes and interfaces in alphabetic order, along with their declaration and usage information. The HTML version of the report includes hyperlinks to the data dictionary report entries, as well as the source code where the reference occurs.

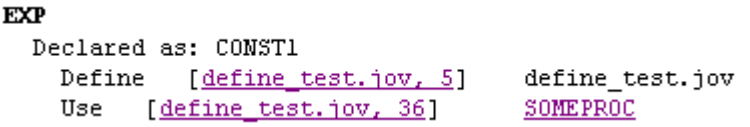
```
Error     (Unknown Class)
  Declared as:
    Create    [REMatch.java, 62]       REMatch.clone
    Create    [Grep.java, 273]         Grep.processStream

Event     (Unknown Class)
  Declared as:
    Typed     [REApplet.java, 198]     e

Exception     (Unknown Class)
  Declared as:
    Extend    [REException.java, 38]   regexp.REException
    Typed     [Grep.java, 236]         ex
```

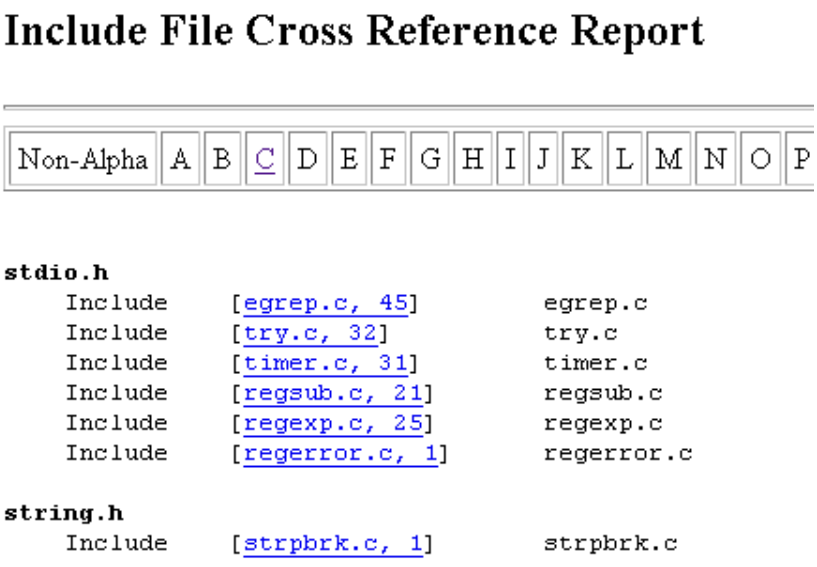
Macro Cross-Reference

The Macro Cross-Reference Report lists all macros analyzed in the source code in alphabetic order along with information about where they are declared and where they are used. The HTML version offers hyperlinks to the macro's Data Dictionary report entry and to the source code where each reference occurs.



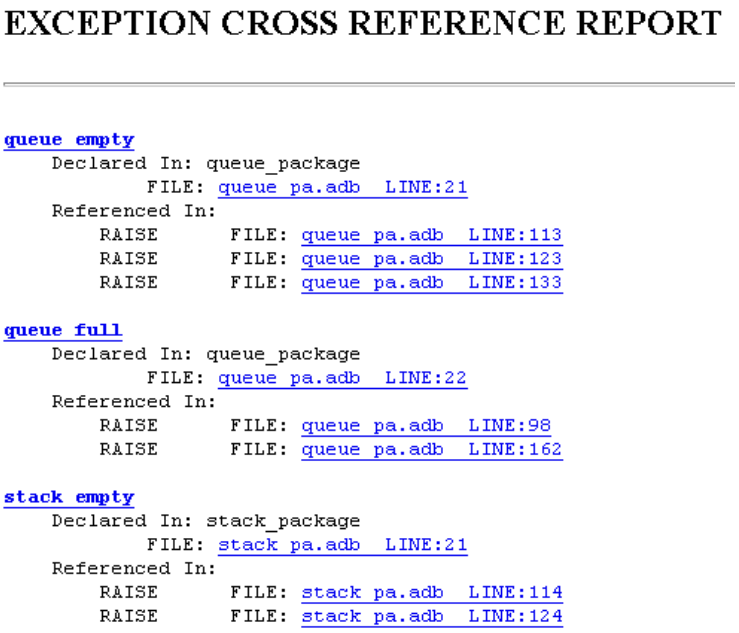
Include File Cross-Reference

The File Cross-Reference Report lists all include files analyzed in the source code in alphabetic order with information about which files include them. The HTML version offers hyperlinks to the source code where each reference occurs.


Include File Cross Reference Report
Non-Alpha A B C D E F G H I J K L M N O P
stdio.h
Include [egrep.c, 45] egrep.c
Include [try.c, 32] try.c
Include [timer.c, 31] timer.c
Include [regsub.c, 21] regsub.c
Include [regexp.c, 25] regexp.c
Include [regerror.c, 1] regerror.c
string.h
Include [strpbrk.c, 1] strpbrk.c

Exception Cross-Reference Report

The *Exception Cross-Reference Report* documents the declaration and usage of all exceptions. Each declaration and any *raises* or *handles* are documented. In the HTML version each raise or handle may be visited in the source, as well as the declaration point of the Exception (if visible).



EXCEPTION CROSS REFERENCE REPORT

queue_empty
    Declared In: queue_package
            FILE: queue_pa.adb LINE:21
    Referenced In:
        RAISE   FILE: queue_pa.adb LINE:113
        RAISE   FILE: queue_pa.adb LINE:123
        RAISE   FILE: queue_pa.adb LINE:133

queue_full
    Declared In: queue_package
            FILE: queue_pa.adb LINE:22
    Referenced In:
        RAISE   FILE: queue_pa.adb LINE:98
        RAISE   FILE: queue_pa.adb LINE:162

stack_empty
    Declared In: stack_package
            FILE: stack_pa.adb LINE:21
    Referenced In:
        RAISE   FILE: stack_pa.adb LINE:114
        RAISE   FILE: stack_pa.adb LINE:124

Structure Reports

Structure reports are designed to help you understand the relationships between various entities. The following table shows the page in this chapter that describes each type of structure report.

Report Name and Page
Declaration Tree on page 10–14
Class Extend Tree on page 10–15
Invocation Tree Report on page 10–16
Simple Invocation Tree Report on page 10–16
With Tree Report on page 10–16
Simple With Tree Report on page 10–17
Generic Instantiation Report on page 10–17
Renames Report on page 10–17
Import Report on page 10–17

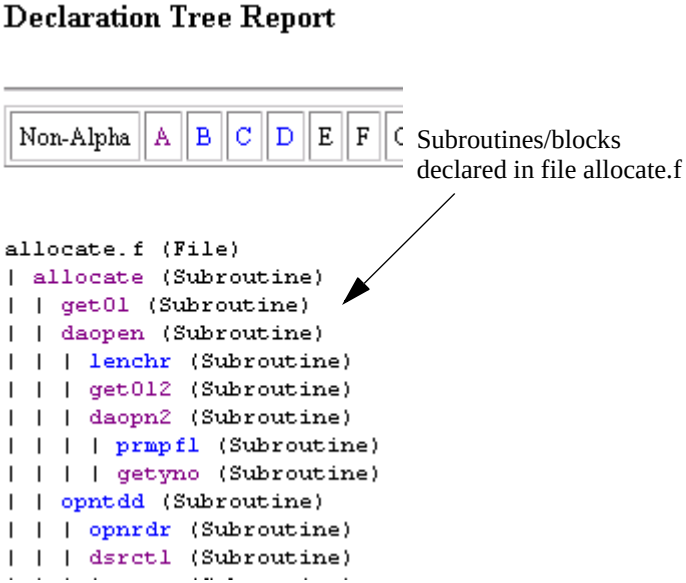
Declaration Tree

The *Declaration Tree* shows the declaration nesting of each program unit analyzed. Each nesting level is indicated by an indent with a vertical bar used to help align your eyes when viewing. Each nesting level is read as “declares”. In the HTML version of the report each program unit name is a hyperlink to its entry in the *Program Unit Cross-Reference Report*.

```
Package Body Occupants
|  Procedure Put_View
|  Procedure Look
|  Procedure Get
|  Function May_I_Get
|  Procedure Drop
|  Function May_I_Drop
|  Procedure Inventory
|  Procedure Go
|  |  Block
```

In the above example, Package Body *Occupants* is the top level program unit. It has declared within it, *Put_View, Look, Get, May_I_Get, Drop, May_I_Drop, Inventory, and Go.* Nested within *Go* is an unnamed declare block.

The Declaration Tree report shows a textual representation of an declaration tree for each FORTRAN file.


Declaration Tree Report
Non-Alpha A B C D E F
Subroutines/blocks declared in file allocate.f
allocate.f (File)
| allocate (Subroutine)
| | get01 (Subroutine)
| | daopen (Subroutine)
| | | lenchr (Subroutine)
| | | get012 (Subroutine)
| | | daopn2 (Subroutine)
| | | | prmpfl (Subroutine)
| | | | getyno (Subroutine)
| | opntdd (Subroutine)
| | | opnrdr (Subroutine)
| | | dsrctl (Subroutine)

Class Extend Tree

The *Class Extend Tree* report shows the nesting of class declarations in the files analyzed. Each nesting level is indicated by an indent with a vertical bar to help align your eyes when viewing. Each nesting level is read as “extends”. In the HTML version of the report each class name is a hyperlink to its entry in the *Data Dictionary and Interface Cross-Reference Report*.

Invocation Tree Report

The Invocation Tree Report shows a textual representation of the invocation tree for each program unit analyzed. The report shows who each program unit calls. Levels are indicated by tabs and are lined up with vertical bars. Each nesting level is read as “calls”.

The HTML version offers hyperlinks to the corresponding Data Dictionary report entries.

definedKey
| hash
| | length
| | Ord
| | Inc
| exit
| newPos
| | Inc

Simple Invocation Tree Report

The Simple Invocation Tree Report shows the invocation tree to only one level for each program unit that has been analyzed.

The invocation level is indicated by an indent and a vertical bar and is read as “calls”.

definedKey
| hash
| exit
| newPos

With Tree Report

Structured identically to the other hierarchy reports, the *With Tree* report shows a textual representation of the With Tree for each program unit that is not Withed by another.

As with the other textual hierarchy reports, indents show level with a vertical bar helping align your eye. For this report, each line is read as “Withs”.

```
Package Body Occupants
|  Package Rename Text_IO
|  |  Package Text_IO
|  |  |  Package IO_Exceptions
|  |  |  Package System
|  |  |  Package Parameters
```

In the above example, the package body *Occupants* Withs package *Text_IO,* which in turn Withs *IO_Exceptions, System,* and *Parameters.*

Simple With Tree Report

The *Simple With Tree* report is similar to the *With Tree* report. It shows a textual representation of the With Tree for each program unit that is not Withed by another. However, it shows only one level of withs. For example:

```
Package Body Occupants
|  Package Rename Text_IO
```

Generic Instantiation Report

This report lists each package that was created through instantiation.

In the HTML version, the source where it was instantiated and its Data Dictionary Report entry may be visited from hyperlinks.

```
My_Int_IO   Package Instantiation
        FILE: board.adb  LINE:12
    Instantiated From =>   INTEGER_IO   Generic
Package
```

Renames Report

The *Renames Report* cross-references the use of the Ada command “renames”, as in:

```
function Rouge return Color renames Red;
```

This report lists program units that have been renamed in alphabetic order. Each rename shows the program unit it renames, and in the HTML report a hyperlink to the rename instance in the source is provided.

The Info Browser also identifies packages and program units that rename others or are renamed.

Import Report

The *Import* report shows lists all source files that import other files and the files they import. The HTML version offers hyperlinks to the data dictionary entry for each imported file.

Quality Reports

Understand 2.0's quality reports are designed to provide information about areas of the analyzed source that might not meet standards or that hold the potential for trouble. They also identify areas where extra programming has been done but not needed. This sometimes identifies areas that aren't yet complete, or that haven't been maintained completely.

The following table shows the page in this chapter that describes each type of quality report.

Report Name and Page
Program Unit Complexity Report on page 10–18
FORTRAN Extension Usage Report on page 10–19
Implicitly Declared Objects Report on page 10–20
Unused Objects Report on page 10–20
Unused Types Report on page 10–21
Unused Program Units Report on page 10–21
Withs Not Needed Report on page 10–21

The complete list of quality metrics available in *Understand 2.0* changes frequently - more frequently than this manual is reprinted. A complete and accurate list is always available on our web site: http://www.scitools.com/metrics.txt. More detail is provided at http://www.scitools.com/metricsexplained.html.

Program Unit Complexity Report

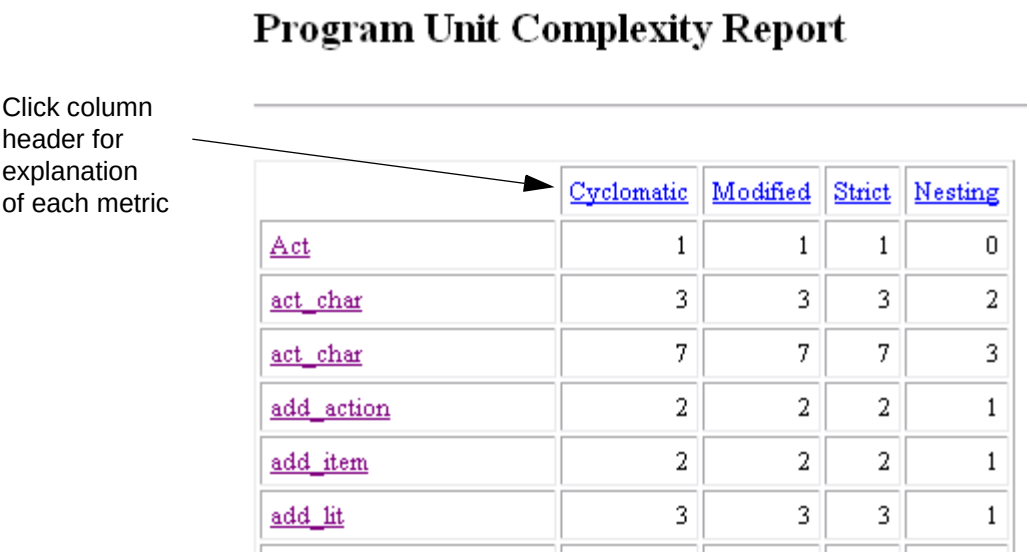
The *Program Unit Complexity Report* lists every procedure and function or similar program unit in alphabetic order along with the McCabe (Cyclomatic) complexity value for the code implementing that program unit.

The Cyclomatic complexity is the number of independent paths through a module. The higher this metric the more likely a program unit is to be difficult to test and maintain without error.

The Modified column shows the cyclomatic complexity except that each case statement is not counted; the entire switch counts as 1.

The Strict column shows the cyclomatic complexity except && and || also count as 1.

The Nesting column shows the maximum nesting level of control constructs in this program unit.

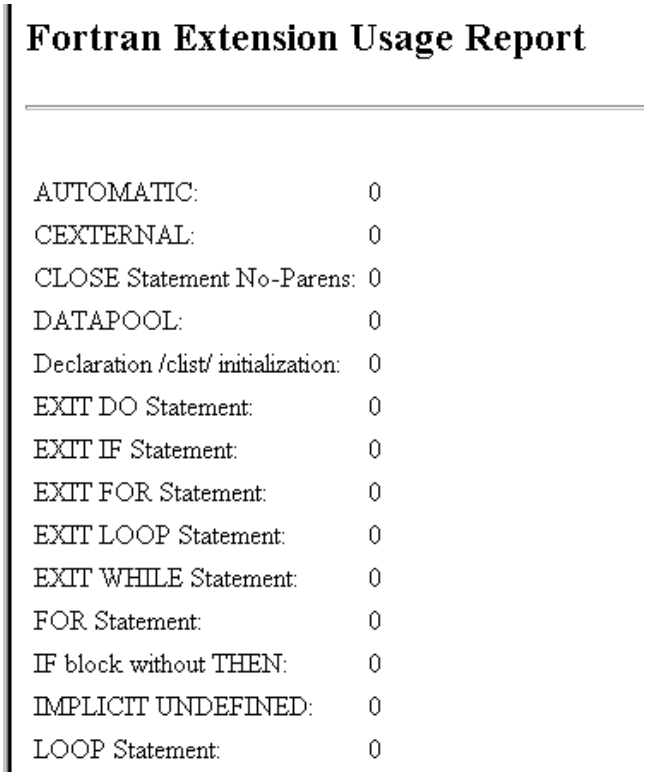


FORTRAN Extension Usage Report

This report lists anywhere your source code has non-standard FORTRAN extensions. The report factors in what variant (F77, F90, F95) you chose on your project configuration.

For information about what FORTRAN language extensions are included in this report, see the Change Log on the Scientific Toolworks website (http://www.scitools.com).

Following is a snippet from a sample FORTRAN Extension Usage report:



Fortran Extension Usage Report

AUTOMATIC:	0
CEXTERNAL:	0
CLOSE Statement No-Parens:	0
DATAPOOL:	0
Declaration /clist/ initialization:	0
EXIT DO Statement:	0
EXIT IF Statement:	0
EXIT FOR Statement:	0
EXIT LOOP Statement:	0
EXIT WHILE Statement:	0
FOR Statement:	0
IF block without THEN:	0
IMPLICIT UNDEFINED:	0
LOOP Statement:	0

Implicitly Declared Objects Report

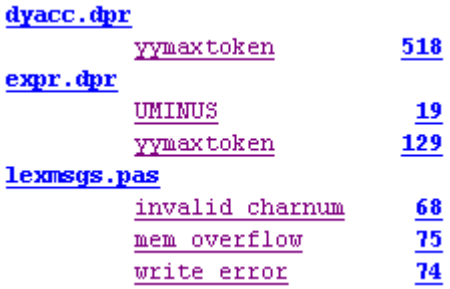
The *Implicitly Declared Objects Report* lists any variables or parameters that were implicitly declared using FORTRAN's implicit declaration mode. Using implicitly declared variables is considered a risky practice, and this report helps you weed out where the practice is occurring in your code.

The HTML version offers hyperlinks to the function's Data Dictionary report entry.

Unused Objects Report

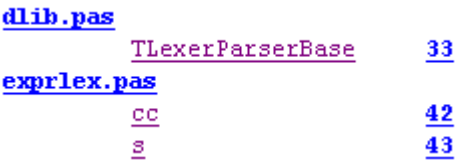
The *Unused Objects Report* lists objects (for example, variables, parameters, constants) that are declared but never used. The HTML

version has links to the function's Data Dictionary report entry and to the source line where the object is declared.



Unused Types Report

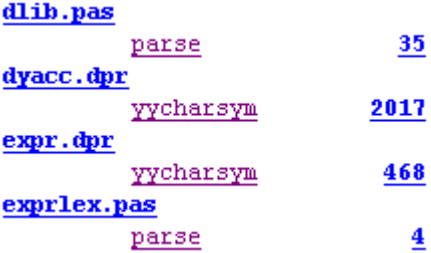
The *Unused Types Report* lists types that are declared but never used. The HTML version has links to the function's Data Dictionary report entry and the source where the type is declared.



Unused Program Units Report

The *Unused Program Units Report* identifies program units that are declared but never used.

Note that this listing in this report doesn't mean the system doesn't need this program unit. For instance, interrupt handlers that are called by system interrupts are often never "used" within the other source of the program.



Withs Not Needed Report

This report lists, any With statements a program unit has but does not need (by not using items made public by the With statement).

Note that this covers only direct usage in the program unit and doesn't account for side effects that may be needed by the program to operate correctly. For instance, sometimes a package can be Withed just to start a task or to execute code in its begin/end block.

Metrics Reports

Metrics reports show basic metric information such as number of lines of code and comments. The following table shows the page in this chapter that describes each type of cross-reference report.

Report Name and Page
Project Metrics Report on page 10–23
Class Metrics Report on page 10–23
Class OO Metrics Report on page 10–24
Program Unit Metrics Report on page 10–24
File Metrics Report on page 10–25
File Average Metrics Report on page 10–26

Ways to Get Metrics Information

Understand 2.0 provides these ways to get metrics information:

- **Info Browser** - The last node on the Info Browser tree is Metrics. This branch can be expanded to show all the metrics available for the currently selected entity.
- **Reports** - These are described below. It is important to note that not all metrics collected are reported. Some are not shown in the reports to save space or because they do not fall into a particular report category.
- **Export -** All metrics may be exported from the **Project-> Metrics Export** menu. Metrics may be chosen. This output is comma-delimited, which allows you to import it into most spreadsheets and databases. See *Exporting Metrics* on page 10–27.
- **PERL/C API -** a more advanced way to get existing metrics, and also to calculate new metrics, is with the PERL and C API. These provide full access to the *Understand 2.0* database. Choose **Help->PERL API Documentation** and **Help->FAQ** for more information. Examples and more documentation can be found at http://www.scitools.com/perl.shtml.

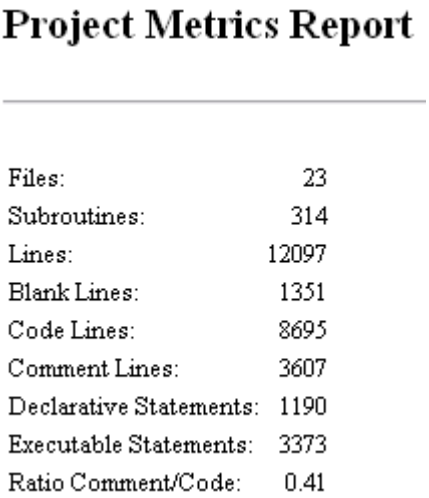
What Metrics are Available?

The complete list of metrics available in *Understand 2.0* changes frequently—more frequently than this manual is reprinted.

A complete and accurate list is always available on our web site: http://www.scitools.com/metrics.txt. The metrics are explained in more detail in http://www.scitools.com/metricsexplained.html.

Project Metrics Report

The *Project Metrics Report* provides metric information about the entire project. The metrics reported include: the total number of files, the total number of program units, and the total number of lines of source code.



Project Metrics Report

Files:	23
Subroutines:	314
Lines:	12097
Blank Lines:	1351
Code Lines:	8695
Comment Lines:	3607
Declarative Statements:	1190
Executable Statements:	3373
Ratio Comment/Code:	0.41

These metrics are also reported on the title page of the HTML report.

Class Metrics Report

The *Class Metrics Report* provides the following metrics for each class that has been analyzed:

- Total number of lines
- Total number of blank lines
- Total number of lines of code
- Total number of lines that contain comments
- Average number of lines per class
- Average number of comment lines per class
- Average complexity per class
- Maximum complexity within class

- Ratio of comment lines to code lines

Class	Lines	Lines Blank	Lines Code	Lines Comment	Average Lines	Average Lines Comment	Average Complexity	Maximum Complexity	Ratio Comment/Code
TLexer	4	0	4	0	0	0	0	0	0.00
TLexer	305	0	297	18	301	18	9	9	0.06

Class OO Metrics Report

The *Class OO Metrics Report* provides the following object-oriented metrics for each class that has been analyzed:

- **LCOM (Percent Lack of Cohesion).** 100% minus the average cohesion for class data members. A method is cohesive when it performs a single task.
- **DIT (Max Inheritance Tree).** Maximum depth of the class in the inheritance tree.
- **IFANIN (Count of Base Classes).** Number of immediate base classes.
- **CBO (Count of Coupled Classes).** Number of other classes coupled to this class.
- **NOC (Count of Derived Classes).** Number of immediate subclasses this class has.
- **RFC (Count of All Methods).** Number of methods this class has, including inherited methods.
- **NIM (Count of Instance Methods).** Number of instance methods this class has.
- **NIV (Count of Instance Variables).** Number of instance variables this class has.
- **WMC (Count of Methods).** Number of local methods this class has.

Program Unit Metrics Report

The *Program Unit Metrics Report* provides information on various metrics for each program unit that has been analyzed.

	Lines	Blank Lines	Code Lines	Lines-exe	Lines-dec	Comment Lines	Ratio Comment/Code
act_char	10	0	10	7	3	1	0.10
act_char	84	1	78	60	16	10	0.13

The following metrics are provided for each program unit:

- **Lines.** Total number of lines in the function.
- **Comment.** Number of comment lines in the function.
- **Blank.** Number of blank lines in the function.
- **Code.** Number of lines in the function that contain any code.
- **Lines-exe.** Lines of code in the function that contain no declaration.
- **Lines-decl.** Lines of code in the function that contain a declaration or part of a declaration.
- **Stmt-exe.** Number of executable statements in the function.
- **Stmt-decl.** Number of declarative statements in the function. This includes statements that declare classes, structs, unions, typedefs, and enums.
- **Ratio Comment/Code.** Ratio of comment lines to code lines. (comment_lines/code_lines)

Note: code+comment+blank != lines
Some lines may contain both code and comments.

File Metrics Report

The *File Metrics Report* provides information similar to that in the *Program Unit Metrics Report*. However, it is organized by file rather than by *program unit*.

Click on each metric column to get a detailed description of it.

Note: code+comment+blank != lines
Some lines may contain both code and comments.

	Lines	Blank Lines	Code Lines	Lines-exe	Lines-dec	Comment Lines	Execution Statements
dlex.dpr	797	86	636	498	112	104	387
dlib.pas	42	13	9	0	9	20	0

Declaration Statements	Mains / Subroutines	Avg. Complexity	Avg. Complexity Case 1	Ratio Comment/Code
46	21	6	6	0.16
3	0	0	0	2.22

File Average Metrics Report

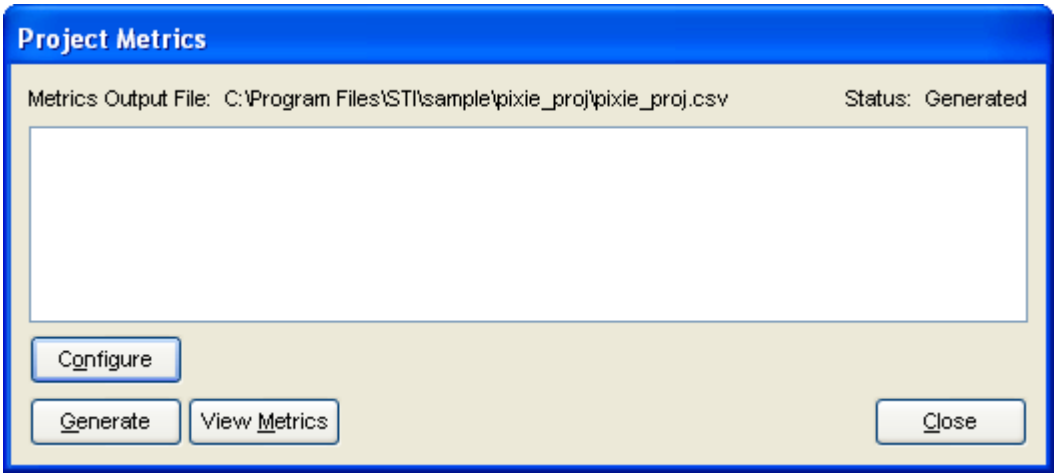
The *File Average Metrics Report* provides averages for the functions within a file. All lines outside any function are ignored when calculating the averages. The following metrics are provided for each function:

- **Cyclomatic.** The average number of independent paths through the functions in this file. The higher this metric the more likely a program unit is to be difficult to test and maintain without error.
- **Modified.** Same as Cyclomatic complexity except that each case statement is not counted; the entire switch statement counts as 1.
- **Strict.** Same as Cyclomatic complexity except that && and || also count as 1.
- **Essential.** Measures the amount of unstructured code in a function.
- **Lines.** Average number of lines in the functions in this file.
- **Code.** Average number of lines that contain any code in the functions in this file.
- **Comment.** Average number of comment lines in the functions in this file.
- **Blank.** Average number of blank lines in the functions in this file.

Exporting Metrics

The Project Metrics Report provides metric information about the entire project. Project metrics can be saved to a comma-delimited text file which can be used in Excel and other spreadsheet programs.

Choose **Project->Project Metrics** to see the Project Metrics dialog.



The **Configure** button opens the Project Configuration dialog with the **Metrics->Options** category selected. See page 3–17 for details.

The **Metrics->Selected** category lets you select from the available metrics. See page 3–18 for details.

After setting options, click **Generate** to export the .CSV file.

A complete and accurate list of the available metrics is available at: http://www.scitools.com/metrics.txt. The metrics are explained in more detail in http://www.scitools.com/metricsexplained.html.

The following is an excerpt of a sample comma-delimited metrics file. When you click **View Metrics**, your default application for .CSV files will run. This is likely to be a spreadsheet application.

```
Kind,Name,AvgCyclomatic,AvgCyclomaticModified,AvgCyclomaticStrict,AvgLines,AvgLinesBlank,
Function,alternate,0,0,0,0,0,0,0,0,0,13,13,17,48,5,43,3
Function,chimaera,0,0,0,0,0,0,0,0,0,19,19,19,95,6,83,13
Function,complain,0,0,0,0,0,0,0,0,0,1,1,1,8,0,8,0
Function,complain,0,0,0,0,0,0,0,0,0,1,1,1,9,0,9,0
Function,egsecute,0,0,0,0,0,0,0,0,0,5,5,7,17,1,16,0
Function,error,0,0,0,0,0,0,0,0,0,1,1,1,9,0,9,0
```

Chapter 11 Running External Commands

This chapter will show you how to configure and use source code editors and other external tools from within *Understand 2.0.*

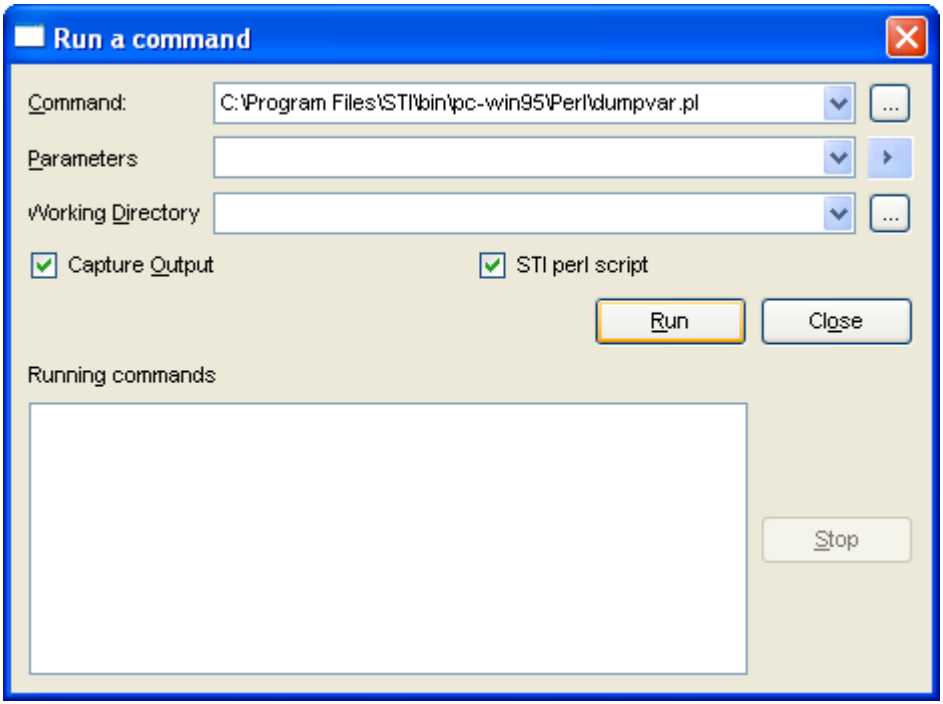
This chapter contains the following sections:

Section	Page
Running External Commands	11–2

Running External Commands

The **Tools->Run a Command** menu item permits any external command to be run directly from *Understand 2.0*. Common commands to invoke are compilers, configuration management tools, and Perl programs written using Understand's API.

The **Run a Command** dialog looks like this:

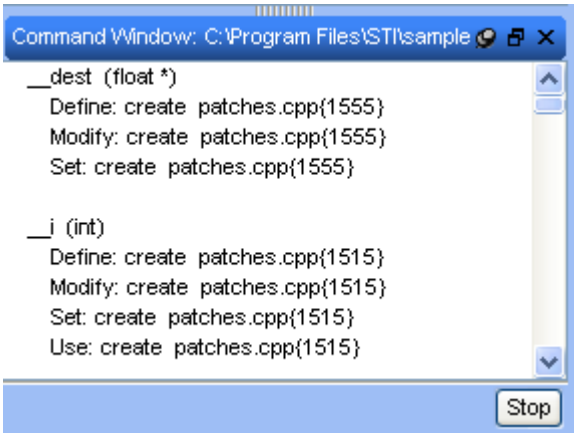


To run a command, follow these steps:

1. Type a **Command** or click **...** and browse for a file to run. A number of Perl programs are provided in the *Understand 2.0* installation.
2. Type any command-line **Parameters** required by the command. Click the right arrow if you want to select one of the special variables. These are listed on page 11–3.
3. Click **...** and browse for the directory that should act as the **Working Directory**.
4. If you want the output sent to a window in *Understand 2.0*, leave the **Capture Output** box checked.

5 If you are running a Perl script, check the **STI Perl script** box if this is a script provided by Scientific Toolworks.

6 Click **Run**. The output is shown in a Command Window in *Understand 2.0* if you checked the **Capture Output** box. Otherwise, the command runs in the background and is listed in the **Running Commands** box. You can select a command from this list and click **Stop** to halt the command.



On UNIX systems, output to both stdout and stderr are captured.

Variables

You can use the following variables in the Command or the Parameter field.

Variable	Description
$CurProject	Current fullname location of opened project
$CurProjectDir	Directory the opened project is located
$CurProjectName	Current short filename of opened project (not including extension)
$CurReportHtml	Current fullname location of opened project's HTML Report
$CurReportText	Current fullname location of opened project's single file Text Report
$CurCol	Current file's column position
$CurEntityScope	Scope of current entity
$CurFile	Current file's full path name
$CurFileDir	Current file's directory
$CurFileShortName	Current file's name without full path
$CurFileName	Current file's name not including extension or full path
$CurFileExt	Current file's extension

Variable	Description
$CurLine	Current file's line position
$CurSelection	Selected text in the Current window (currently file windows only)
$CurWord	The word/text at the current cursor position in the current file window
$DeclCol	Column in which the selected entity was declared, defaults to 1
$DeclFile	Full path name of the file in which the selected entity was declared
$DeclLine	Line in which the selected entity was declared, defaults to 1
$PromptForText	"text descriptor" before executing command, prompts user for this needed string parameter

Chapter 12 Command Line Processing

This chapter shows how to create an *Understand 2.0* database by analyzing your source code, and how to generate reports from the command line. Command-line processing can be used in a batch file for automatic re-building and report generation of projects.

This chapter describes the “und” command-line programs, which allows you to analyzes sources and create *Understand 2.0* databases from the command line. In addition, it allows you to generate reports.

(The “und” program replaces the previous und* and rep* language-specific programs. Existing batch files and shell scripts that ran the old programs will need some modification.)

Most examples in this chapter refer to C/C++ files. However, you can use und with any supported language.

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Using the und Command Line

A command line tool for creating and building *Understand 2.0* databases is *und.* This command line program parses your source code to populate the database with information that can be browsed or reported on.

If you will use the “und” tool frequently, you should put it in your operating system’s PATH definition.

The “und” command line takes the following form, where *filename* is the project database file and is a required argument.

```
und -db filename [options]
```

Create a new database using the -create option and then load the files into the database with the -addDir and -addFiles options.

To parse all files, specify -analyze.

The effects of all commands are permanent. There is no option to make temporary changes as there was in previous versions.

All options that set the configuration are performed before any report or analyze options, no matter what the sequence of the options on the command line.

Refer to the sections that follow for details on all the available command line options and how to create and analyze a project.

Getting Help on Command Line Options

Since we do frequent builds of *Understand 2.0*, it is likely that this manual may not describe all the options of the “und” command line.

The und tool lists its command line options when passed the -help option:

```
und -help
```

Individual options provide a brief explanation when passed with the -help option. The following example explains the -create option.

```
und -help create
```

Some options are only listed in the command-line help if you get help on their master option. For example:

```
und -help addDir
```

You can use the -list option to get a list of language-specific settings for an option. For example, the following commands list the available settings for a C++ project for the -compiler_name option.

```
und -db myproject -C++ -list compiler_name
```

Creating a New Project

There are several ways to create a new project file using “und”. Of course you can use the graphical interface of *Understand 2.0* to first create your project, but here we will examine a few ways to do it from the command line.

To create a new, empty, project called sample.udb:

```
und -create -db myproject
```

This example creates a database called *myproject.udb*.

Creating a Project and Adding Sources in One Step

You can create and add files to the database all in one command. For example:

```
und -db myproject.udb -create -addDir \usr\myfiles
```

Adding Files to a Project

If you have a small number of source files then it may be easiest to just supply their names to the analyzer using the wildcarding abilities of your operating system shell. In this example we will process all source files in the folder:

```
und -db myproject.udb -addDir \usr\myproject
```

In some cases there may be too many file locations to use the *-add* technique. A common command line limitation is 255 characters. A directory with hundreds or thousands of files may easily exceed this limit. In this case, or when you want more fine-grained/repeatable control over what files are processed, you should create a “listfile”. This file must have a format of one filename per line:

```
c:\myfiles\myproject\myproject.c
c:\myfiles\myproject\myproject.h
c:\myfiles\myproject\support.c
c:\myfiles\myproject\io.c
c:\myfiles\myproject\io.h
h:\shared\allprojects\file2.c
h:\options\file3.c
h:\options\file4.c
h:\options\file5.c
. . .
```

is processed via the *-addFiles* command line option:

```
und -db myproject -C++ -addFiles @myfiles.lis
```

Note that there is no limit on the number of files listed in the list file.

Creating a List of Files

On UNIX here are a couple ways to create such a file:

- Use the 'ls' command, as in:

```
ls *.c *.h > my_project.lst
```

- Use the 'find' command to recurse subdirectories, as in:

```
find . -name "*.c *.h" -print > my_project.lst
```

In a Windows command shell:

- Use the dir command with the /b option:

```
dir /b *.c *.h > my_project.lst
```

- Use the /s option to recurse subdirectories, as in:

```
dir /b /s *c *.h > my_project.lst
```

Analyzing a Project

The "und" command line program allows you to analyze (or re-analyze) a previously created project database.

When analyzing a project, you have several options to choose from. You may re-analyze all files with the -analyzeAll option, only those files that have changed with the -analyze option, or a list of files with the -analyzeFiles option.

If you are doing your first analysis after creating a new project, it doesn't matter which option you choose as it will parse all files regardless. However, if you are performing this function on a regular basis, you may prefer to do an incremental analysis where only the modified files and any other files dependent on those files are re-analyzed.

For example, you can parse all files in the project with the following command:

```
und -db myproject.udb -analyzeAll
```

Or, to perform an incremental analysis, re-parsing only those files that have changed or other dependent files, use the command:

```
und -db myproject.udb -analyze
```

This command checks each file previously parsed into the repository to see if it has changed. If it has changed then it will re-parse it, and any files that depend on it (and so on) until the database is fully refreshed.

Use this feature to keep your database up to date while keeping your parsing to a minimum.

Command Line Options

The only required option for all commands using “und” is the -db option to specify the project database file.

Command-lines for multi-language projects must also use an option to specify which language you are configuring if you use a project configuration options. For example: -C++, -Java, or -Pascal.

Where a command accepts a @lisfile.txt for an option, the file must contain one item per line. Full or relative paths may be used. Relative paths are relative to the -cwd directory. A # sign in the first column of a line in the file indicates a comment.

The following table lists the command line options for “und”:

Option	Description
-db *filename*	Specify the name of the database to create or open. An extension of .udb is provided if no extension is given. You can use a filename in the current directory or a full path to the file. This option is required for most actions.
-Ada -Assembly -C++ -C# -Fortran -Java -Jovial -Pascal -Plm	Sets the language that this configuration applies to. Required for configuration actions on multi-language projects when you set items that apply to multiple languages, such as -include.
-addDir *directory*	Add the specified directory as a source file directory to the project. When adding directories, you can also use the following -addDir* options.
-addDirExcludes *wildcard1 wildcard2...*	Add the specified paths or wildcard patterns to the list of files to be excluded from the project.
-addDirFilters *wildcard1 wildcard2...*	Use the specified filetype filters to match source files in the directories specified by -addDir.
-addDirLangTypes *lang1 lang2...*	Add only files that match the filetypes for the specified languages.
-addDirSubdirs [On/Off]	Specify On if you want subdirectories of the directory specified with -addDir to also be added.
-addDirWatch [On/Off]	Specify On if you want the added directory to be a watched directory.

Option	Description
-addFiles *file1 file2 ...* or -addFiles @*lisfile.txt*	Add the listed files to the project. Filenames can be relative to -cwd or can use a full path.
-analyze	Analyze (parse) any changed files in the project.
-analyzeAll	Analyze all files in the project.
-analyzeFiles *file1 file2...* or -analyzeFiles @*lisfile.txt*	Analyze the specified list of files.
-arch <name>	Specify the name of an existing architecture for use with other options.
-archDelete	Delete the architecture specified with the -arch option.
-archRename *newname*	Rename the architecture specified with the -arch option.
-archExport *export.xml*	Export XML for the architecture specified with the -arch option.
-archImport *import.xml*	Import XML for an architecture from the specified file.
-assembler *name*	Set the configured name of the assembly language assembler.
-compiler_name *name*	Set the configured compiler for the specified language.
-compiler_version *version*	Set the configured version of the compiler.
-create	Create a new project with the given -db *filename*. If the .udb file exists, it will be replaced with new empty project. Use -languages to set the source code language(s) for the new project.
-cwd *directory*	Set the current working directory for other relative filenames, such as those provided with -db and -report_htmldir.
-define *macro1=def1 macro2=def2...* or -define @*lisfile.txt*	Defines macros that may be used with #ifdef and similar preprocessor directives.
-fileType *ext1=lang ext2=lang...*	Add a file extension and specify the language it should be treated as.
-fileTypeDel *ext1 ext2...*	Delete the specified file extensions associations.
-help *option*	Provide information about an option.
-include *includedir1 includedir2...* or @*lisfile.txt*	Add the specified directories to the list of include directories.

Option	Description
-include_addfound [On/Off]	Set to On if you want include files found when analyzing a project to be automatically added to the source file list.
-include_addfoundsys [On/Off]	Set to On if you want system include files found when analyzing a project to be automatically added to the source file list.
-include_case [On/Off]	Set to On if you want to use case-insensitive searching for include files.
-include_search [On/Off]	Set to On if you want to search for include files among project files.
-include_treatsys [On/Off]	Set to On if you want to treat system include files as user include files.
-languages *lang1 lang2...*	Specify the source code languages used by the project.
-list *option*	List the available settings for the specified command-line option.
-listarch	List all the architecture names in the project.
-listfiles	List all the files in the project database.
-listfilestree	List all the files in the project database in tree format showing watched states.
-metrics [*outputfile*]	Generate list of currently selected metrics. If an outputfile is optionally specified, send the output to that file.
-metrics_sel *metric1 metric2...* or -metrics [all/none]	Add the specified metrics to the list to generate. To clear the list, use none. Use -list metrics_sel to get a list of metric names.
-metrics_DeclFilename [none/short/relative/full]	Specify whether “declared in” filenames should be shown as short, relative, full, or not at all (none).
-metrics_Filename [short/relative/full]	Specify whether filenames should be shown as short, relative, full, or not at all (none).
-metrics_Parameters [On/Off]	Set to On if you want function parameter types shown in metrics output.
-metrics_Titles [On/Off]	Set to On if you want column headings in metrics output.

Option	Description
-process *commandfile.txt*	Pass a file containing command-line options to und. The most recent -db setting is use for commands in the file.
-quiet [On/Off]	Set to On if you want only errors that would cause a failure to be reported to the display.
-removeDir *directory*	Remove the specified directory and its subdirectories from the project. If a directory is watched, it is set to exclude.
-removeFiles *file1 file2 ...* or -removeFiles *@lisfile.txt*	Remove the listed files to the project. Filenames can be relative to -cwd or can use a full path. If the files are watched files, they are set to excluded files.
-report *html text*	Generate currently selected reports. If html or text is optionally specified, generate only that type of output.
-report_sel *report1 report2...* or -report [all/none]	Add the specified reports to the list to generate. To clear the list, use none. Use -list report_sel to get a list of report names.
-report_htmldir *directory*	Specify a directory to contain HTML report output.
-report_htmlstyle [single/alpha/split=N]	Specify how HTML reports are to be split.
-report_htmltitle *titlepage*	Specify the filename of an HTML page you want used as the title page.
-report_Filename [short/full]	Specify whether you want the reports to use short or full filenames.
-report_time [On/Off]	Set to On if you want the time the report was generated to be placed on the report.
-report_textdir *directory*	Specify a directory to contain text report output.
-report_textfile *filename.txt*	Specify a filename for the text report if you are using the single file option.
-report_textstyle [single/separate]	Choose whether you want text reports sent to a single file or separate files.
-rescan	Rescan all the watched directories for newly added or removed source files.

Option	Description
-rootAdd *name1=directory1* [...]	Create or reset one or more named root directories. If the root does not exist in the current project, it is added. Otherwise, its mapping is reset to the new directory. A valid name must begin with an uppercase letter (A-Z) and be followed by at least one more uppercase letter, numbers, “_”, or “$”. This is a temporary setting that applies to the current command only. If you use this option in a commandfile.txt for the -process option, it applies to multiple commands.
-rootList	List the defined named root directories.
-rootMode *mode*	Set the current default mode for adding named roots.
-rootRemove *name*	Remove the specified named root definition.
-rootReset *name=directory*	Sets the directory for the specified named root to the specified directory. If the root does not exist in the current project, an error occurs. This is a temporary setting that applies to the current command only.
-snapshot *name*	Create a new snapshot with the specified name.
-snapshotComment "*Comment*"	Associate the specified comment with the snapshot specified by the -snapshot option.
-vsFile *filename*	Add the specified Visual Studio file to the project configuration.
-vsFileConf *configuration*	Specify the Visual Studio configuration to use for the specified -vsFile.
-vsFileDel *filename*	Remove the specified Visual Studio file from this project.

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